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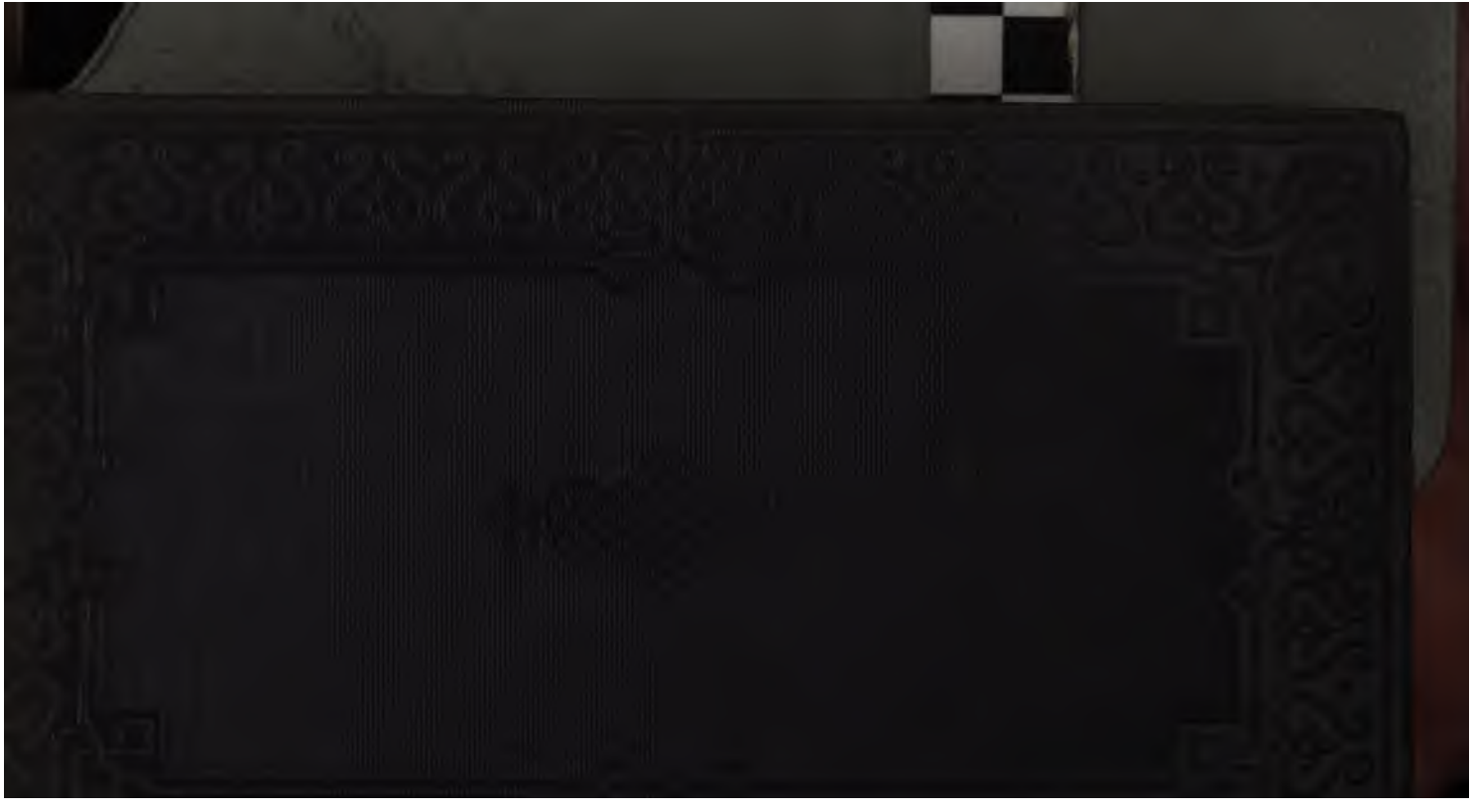

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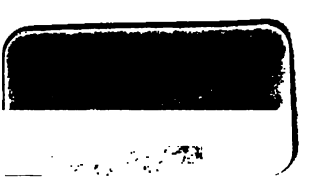

# SACRED GEOLOGY.

# SACRED GEOLOGY;

OR,

## THE SCRIPTURAL ACCOUNT

OF THE

## WORLD'S CREATION MAINTAINED;

AND REASONS ASSIGNED FOR QUESTIONING

## That Geological Hypothesis,

CONCERNING

## THE SEDIMENTARY FORMATION OF STRATA,

FROM WHENCE THE INFERENCE HAS BEEN DRAWN
THAT

INCONCEIVABLY LONG PERIODS OF TIME ELAPSED
BETWEEN EACH OF THESE FORMATIONS,

AND BEFORE

## THE CREATION OF MAN.

BEING A SERIES OF PAPERS ORIGINALLY WRITTEN FOR "THE CHURCH OF ENGLAND QUARTERLY REVIEW," AND NOW FOR THE FIRST TIME COLLECTED TOGETHER.

LONDON:
WILLIAM EDWARD PAINTER, 342, STRAND.

1847.

BIBLIOTHECA · BODLEIANA
DOMINUS ILLUMINATIO MEA

# PREFACE.

THE following papers on SCRIPTURAL GEOLOGY appeared at sundry times, and with intervals of considerable length between one and another of them, in the *Church of England Quarterly Review*: yet as their object was the same, and the subject treated is not of a temporary character, it has been thought adviseable to collect them into one volume, that the reader may have before him the whole line of argument.

The purport of the writer was to put some check on rash speculations, by endeavouring to show that those geologists, who are forsaking the safe paths they once kept to—the path of exploring step by

step, and collecting additional facts, and making these facts the basis of every new discovery and the fulcrum for removing every obstacle—are, in deserting these old paths, venturing on unsafe and treacherous ground; and, while they please the fancy, by theories of Creation and speculations concerning former worlds, that they are not only running too fast in doing this without the basis of fact, but are actually contradicting those facts which they are professing to explain. The facts not only do not warrant the speculations, but actually refute them: and, before such speculations can be tolerated, these geologists must get rid of their own acknowledged facts.

The primary fact in Geology, on which everything else depends, is the regular order of the grand formations, or mountain masses, in all known parts of the world: each bed of rocks occupying a constant position in reference to the surrounding masses, and each distinguishable

from every other formation, both as to its mineral composition and as to the species of fossils that are imbedded in its mass. These distinctions afford an admirable basis for the natural classification of rocks, and have both sharpened observation and afforded facilities for description to a degree that can scarcely be rated too highly. The discovery of them has rendered immense service to Geology, accelerating its progress and giving increased accuracy to its facts, with every fresh observation. But, as yet, nothing further has been done than collecting and classifying the facts: no insight has been afforded whereby the causes of this order may be known: and still less can we discover, by means of them, Creation in its proper sense, or the origin of the things themselves.

Even if, by Geology, we were made acquained with an order which had subsisted from the beginning, such knowledge as this would not help us to the

origin of the things or the cause of the order discovered: just as we do not expect by the Linnean system, or any other system of Botany, to become acquainted with the origin of plants; and yet plants present the more hopeful field of the two, for they are still living, and we see them in course of growth and reproduction; but rocks are fixed, lifeless masses, regarded as matter; and the strata and their contents not only so, but the wrecks and ruins of a former state of things—of matter which once had a different form, though we know not what—of beings which once possessed life, though we know not under what circumstances, or how they were laid in their present rocky sepulchres. We know it not from Geology—we read it not in those beds of death which we behold. In what degree we may hereafter discover the truth, by comparing these facts with the revealed history of the Creation and of the Deluge, is quite another affair: we are only now

stating a geological axiom, that the earth itself is silent as the grave concerning her past history.

The geologists to whom we allude assert that the earth does tell its own tale, and here it is that we join issue with them: we assert that it is not the earth, but they themselves and their imagination, that speaks; and, in the things they say, that they bear false witness to and slander old mother earth, by calling her infinitely more aged than she owns to: and it is in defence of the earth's consistency and propriety, that she may not be unjustly deemed superannuated, nor lie under the imputation of being in her dotage, and subject to unbecoming freaks and vagaries, that we have undertaken to speak a word in her favour.

It may save our readers some trouble if we state in a few words the main points on which we are at issue with the geologists. The first of these points has reference to the kind of agency and mode of

composition observable in the rocks or strata which constitute distinct formations; for it is asserted that all these consist of the detritus of older rocks which have been held suspended in water for a time; and then the stony particles, subsiding by their own weight, the deposit has, after a length of time, hardened into stone. To this first point we have two grounds of objection—the one being as to the ingredients, since each formation is distinct in some of its ingredients from every other formation; and it is not possible that the detritus of granite, deposited from an aqueous solution, should take so many and such very distinct forms. Many of the strata and beds have scarcely an ingredient in common, and could not be derived the one from the other; for how could ingredients be washed out of older rocks which those rocks do not contain? And if the new ingredients, which sometimes, as in the case of chalk, form nine-tenths of the mass, be ascribed to some

other agency, this is not only shifting the ground, but is an abandonment of the whole theory regarding detritus and sediment. The other ground of objection relates to the supposed consolidation of these supposed deposits; for it is only assumed, and it yet remains to be proved, that such a sediment would, by any length of time, be hardened into rock. The only similar deposits we know of are mud, sand, &c., which seem to remain the same mud and sand for ever. It is allowed that no such induration has taken place since the Creation of man, in referring every stratum, without exception, to a time anterior to that epoch; therefore, man has no knowledge of the possibility of this induration by time: and intermingled with the beds of solid rock there are beds of mud and sand. How then did these escape induration, if time be the only requisite?

Then, in regard to the fossil contents of these various formations, it has been asserted that, whereas no human bones have

hitherto been found in a fossil state, none such will ever be discovered; and that, because all these formations took place before the Creation of man. This seems to be a very bold assertion, and one which the discovery of a single relic of man, or of an unsuspected formation, like Murchison's Silurian, might any day refute. It was as confidently asserted, at one time, that the old red sandstone contained no animal remains; but the Silurian system is an evidence of the folly of that assertion; and, if we are rightly informed, there are discoveries in progress, both in Germany and America, which, in like manner, refute the assertion that no human relics exist among the fossiliferous deposits.

The calculations which have been hazarded concerning the inconceivably long periods of time before the Creation of man that would be required to accumulate and consolidate the various strata, which calculations form the most ludicrous as

well as the most repulsive feature of these speculations, all depend upon the points which we have already mentioned—viz., upon the length of time which would of necessity be required, first, to dissolve the older rocks by the agency of water only; secondly, to heap up the detritus in sufficient quantity; and, thirdly, to consolidate each stratum in succession to that extreme hardness, in such countless numbers and such prodigious volume, as to form those enormous masses of myriads of strata which constitute the great mountain ranges. These calculations, therefore, stand or fall with the preceding hypothesis. If rocks cannot be formed by the agency assumed, no length of time can avail to accomplish that which is impossible, or to render probable that which bears strong marks of impossibility on its face. But it may be observed that self-contradiction is involved in the notion of these endless new formations by the detritus of the older; for, regarding the

earth as a whole, there could be no succession, no possible increase, in this way; since, if the materials for a new stratum are to be procured by an abrasion of the earth's surface, this detritus and the destruction of the already existing strata would be in exact proportion to the bulk of the new stratum—it would be only the same materials washed up again, to be deposited in another form—there could be no new ingredients, no increase.

There is also a point of the highest importance, the exclusion of which from these speculations is as repugnant to our faith as the rash and unwarrantable assertions are to our reason—viz., the Deluge of Noah. No geological theory is, in our estimation, worthy of entertainment by any Christian which does not take in the Deluge, a literal, an universal, a miraculous Deluge, according to the declarations of the Old Testament, attested by the numerous allusions to it of Christ and the apostles in the New Testament. And, in

this point of view, we have referred to a fact which has been kept out of sight and virtually suppressed by those who indulge in such speculations, that the mammoths of Siberia unquestionably existed up to the time of the last universal catastrophe; and, therefore, some of the extinct races of animals existed up to the Deluge of Noah.

To admit *any* universal Deluge, even such as the geologists require for the production of their strata, is equivalent to the admission of *supernatural* agency; for we have shewn that no *natural* or physical agents, such as rains, floods, or earthquakes, could possibly produce an *universal Deluge.* Nothing short of the subsidence of *all* the land could cause the rise of *all* the water. The Deluge, as described by Moses, was most certainly *supernatural,* and is therefore ascribed by him to the direct interposition of God:—"Behold I, even I, do bring a flood of waters upon the earth;" while the geo-

logists, when they speak of it at all, most unaccountably assume that it was brought about by *natural* causes. And it ought not to be forgotten that the legends of most countries retain traces of a flood leaving behind it monsters which their national deities ridded them of, like the Greek legend of Apollo Pythius, and even the "big bull" of the American Indians. And as the mammoths of Siberia are certainly relics of the Deluge, but are indebted to the climate for their preservation, so we assert that there were similar relics of other animals in all climes, though they have perished in other latitudes from not having been locked up in the ice. The existence of the Siberian mammoths is ground enough for the assertion. The *onus* of disproving it rests with the geologists.

And not only as to the Deluge, but in any other aspects of the subject which bear upon matters of religion or faith, we feel constrained to bring all such theories

to the test of the Word of God; being assured that, if they are contrary to the plain import of Scripture, they will be also contrary to right reason in the best sense of the word—contrary to true wisdom, which is based on true theology; and, as such, will tend to subvert the faith, and produce utter carelessness or total infidelity in the affairs of religion. On these accounts we have endeavoured to determine the doctrinal questions which are involved in these discussions, and we have shewn that Creation was not without design—was not independent of man; but that, on the contrary, all this goodly frame was from the beginning formed and ordered according to a plan and purpose of which the creature, Man, was to be the full and complete exponent; and that, notwithstanding the fall of man, this original design of God shall have its final accomplishment, of which we have the earnest and assurance in the incarnation and resurrection of the Son of God.

Therefore, it is inculcated by the apostle that all things were made by Christ, and for Him; and that He is before all things and by Him all things consist: and to ensure this final purpose the whole Creation has always been kept in the hands of God. It has not been left to be the sport of chance: it has been steadily working on to accomplish the purposes which infinite wisdom, seconded by almighty power, designed from the beginning. Its commencement is revealed, and *we understand it by faith;* for "through faith we understand that the worlds were framed by the word of God" (Heb. xi). Its termination also is revealed to faith, and is the object of our hope—faith which is the substance of things hoped for, the evidence of things not seen. In this spirit and with this faith and hope, we commend what we have written to our readers. And may God accept our endeavour and follow it with His blessing

FOR CHRIST'S SAKE.

# INDEX.


A.

Act of Creation ..... 171
Agassiz, M., Ichthyology 35
——, on Glaciers ..... 99, 103
Agency now at Work..... 53
Aggregate of Animal Enjoyment increased by Carnivorous Races ..... 132
Alchymist ..... 165
Ammonites ..... 58
Ancient World ..... 394
Ancient Cosmogonies ..... 399
Andes ..... 288
Anglesea Granite..... 62
Angels not standing in Federal Headship ..... 372
Animals Created Harmless 380
—— had not sinned ..... 370
—— types of Man..... 82
Ansted, Professor, 231, 237, 276, 394
Anthracite ..... 334
Ascending Order..... 32
Atlantis of Plato..... 108
Atmosphere limited 403, 428
Atomic Theory ..... 166, 170
Australia..... 277
Australian Flora..... 329
Auvergne ..... 321

B.

Bacon ..... 112
Bagshot Sand ..... 249
Bailly ..... 362
Bakewell..... 338
Basalt ..... 295
Beaches raised ..... 295
Beacheyhead ..... 46
Bear Mountain ..... 334
Beasts of Prey.....132, 422
Bed of Death ..... 320
Behmen, Jacob ..... 116
Bible is true philosophy 18, 25
——, Importance of the... 73
Blackfriars Bridge ..... 22
Boulders ..... 108
Bovey Coal ..... 298
Breaking up the Great Deep ..... 89
Bridgwater Treatise ..... 61
Buckland, Dr., ... 25, 42, 51
Buckstone ..... 216, 225
Burnet ..... 112
Burton, Rev. C., ... 139, 195

C.

Cairngorum..... 221
Calcareous Strata ..... 43
Carbonate of Lime ..... 42
——, covers one eighth of the Surface of the Earth 43
Carnivorous Animals 85, 129
Catastrophe, the Last..... 55
Cause, most general ..... 124
Central Heat ..... 112
Chalk, Source of..... 42
Chalk Group ..... 315
Chalmers, Dr. ..... 71
Chenevix ..... 36
Chepstow ..... 309
Chesil Bank ..... 219
Classification of Animals... 84, 92, 158

Clayslate ..... 312
Cleavage of Minerals..... 228
Cleavage and Crystallization ..... 236
Clergy, teachers of others 24
Clifton Strata ..... 309
Colossal Egyptian heads... 217
Coal Measures 314, 389
Coal of Australia..... 329
Comets move orderly ..... 97
Conglomerates..... 209, 307
Consolidation of Strata ... 48
Continuity of purpose ... 186
Contorted Beds ..... 237
Contortions ..... 311
Cordier, M. ..... 112
Cosmogonies..... 75, 398
Created, Made, and Formed 72
Creation, a Sacred Word 425
Creation Proper ..... 71
Creation of Genesis..... 79
Creation one System ..... 375
—— all things linked together .. 81
—— each thing matured 156
—— each act promising more ..... 380
Creator does not change His plan ..... 164
Creator is Christ..... 184
Cromarty, richly fossiliferous ..... 22
Crosse's Experiments ..... 36
Crushed, Echini ..... 235
Cuvier, Baron ..... 35

D.

Dalton's Definite Proportions ..... 166, 428
Dartmoor Granite ..... 62
Dauphiny Eruptions ..... 321
Davy, Sir H. ..... 36
Deep Water Shells..... 341
Deluge of Noah ... 27, 69, 190
—— by the Hand of God 163
—— Supernatural ... 28, 88
—— Unprecedented 87, 188
Denderah Zodiac..... 362
Denudations ..... 46
Deposits ..... 284
De Saussure ..... 289
Descending Order ..... 32
Development not Fact ... 420
Devonian Strata ..... 41
Dirt Beds ..... 296
Disturbances of Beds..... 308
—— of the Compass ..... 233
Dolcoth Mine ..... 114
Doubting Spirit ..... 197
Downs, North and South 46
Dragons' Bones ..... 33
Drops of Rain..... 205
Dumfries Sandstone ..... 40
Durdham Downs..... 309

E.

Echini in Chalk..... 57
Echini Crushed ..... 235
Edinburgh Geologists..... 268
Elephants in the Frozen sea ..... ..... 34
England's Strata..... 271
English Geologists ..... 269
Enjoyment consists in Employment ..... ..... 20
Enthusiastic Votary ..... 117
Epochs, Geological, three 405
Erie, Lake ..... 339
Eruptions of Mud ..... 91
Eusebius Præp. Ev..... 75
Extinct Elephants ..... 55
Extinct Races..... 423

F.

Facts of Revelation..... 390
Faith the way of Knowledge ..... ..... 185
Fall, its Consequences..... 350
Faluns of the Loire..... 336
Fishes, violently crushed 245
Flint in Solution..... 58
Floating Islands ..... 297
Foot-marks of Dumfries... 56
Foot-prints of Connecticut 335
Forbes, Professor E. 223, 341
Fossils partake of the Nature of their Beds ..... 302

Fossil Wood ..... 300
Fountains of the Great Deep ..... 89

G.

Galileo ..... 93, 201
Geological Society ... 100, 269
Geologists, the Older ..... 26
Geologists, Early ..... 30
Geology, a New Science... 145
——, conversant with Wrecks and Ruins alone, not with existing Things..... 347
Geology, scriptural..... 391
—— rests on the supernatural..... 177
German Geologists ..... 267
Giants' Bones ..... 33
Gigantic Birds..... 327
Glacial Theory..... 99
Gneiss ..... 312
God the Doer of all..... 161
God alone can suspend His Laws ..... 162
God Incarnate ..... 375
Godlike Creature Man .... 81
Granite Fundamental 247, 409
Granite Peaks..... 52
Granite Veins ..... 32
Granite compared with Chalk ..... 42
Granitic Crust..... 51
Gravitation ..... 165
Grenelle Well..... 113
Groups are three..... 311
Guadaloupe Remains ..... 368
Guilt implies Consciousness..... 371
Gulph Stream ..... 115

H.

Hall, Sir James 36, 255, 268, 289
Hastings Sand ..... 315
Hatchett's Experiments ... 36
Hauy, M. ..... 234
Hawkins, Mr..... 55
Heat Central ..... 112
Heat, Increase of ..... 113
Hebrew Criticism ..... 72
Herculaneum ..... 87
Hereford Grit..... 212, 226
Hill, Sir John..... 289, 303
Hipparchus ..... 140
Human Remains not found 33
—— may yet be found 86, 383
Huttonians ..... 31
Hypothesis is not Fact ... 363

I. J.

Jamieson, Professor ..... 295
Jarrow Colliery . . ..... 309
Ice Preserved Animals ... 55
Ichthyosauri..... 35, 422
Iguanodon ..... 54
Ilfracombe ..... 237
Impediments of Knowledge ..... 123
Impossibility at Present... 277
Independent Coal Formation ..... 298
Ingredients of Strata..... 41
Jupiter's Moons ..... 404
Jura Transported Blocks... 108

K.

Kensington Gravel ..... 249
Keyserling, Count ..... 17
Knowledge of God..... 118

L.

Labour conducive to Happiness ..... 21
Land formed miraculously 110, 152, 175, 246
Lava becoming Lime ..... 44
Laws now in Operation ... 49
Leith Hill ..... 322
Lisbon Earthquake..... 87
Litany..... 321
Local Attraction ..... 233
London Clay ..... 35, 249
Loose Statements ..... 51

Lowest Rock ..... 247
Lyell's Geology ..... 17, 108
—— N. America ... 253, 332
Lyme Regis..... 55

M.

Macculloch ..... 295
Maclaren's Analysis ..... 99
Malvern Hills..... 256
Mammoth of Siberia 55, 186
Man the Image of God 73, 81
—— Last work of God 80, 429
—— Exponent of Creation ..... 349
—— Typified in Animals 82
Man and Woman, Christ and the Church ..... 349
Mantell, Dr. ..... 54
Map of England..... 273
Marine Productions ..... 59
Marsupialia..... 328
Matter, Life, and Spirit ... 72
Matter Indestructible..... 164
Medals of Creation..... 417
Mediterranean Fauna..... 341
Metamorphic Rocks ..... 412
Miller, Hugh ... 17, 223, 225
Millstone Grit..... 212
Mineralogy ..... 247
Mineral Ingredients ..... 249
Modern Theory ..... 399
Moral Government of the Universe ..... 424
Moral Beings alone contract Guilt ..... 349
Morvheim Sandstone ..... 63
Muddy Eruptions ..... 91
Murchison, Sir R. I. 17, 23, 40
Mylodon ..... 396

N.

Nare Point ..... 291
Natural Religion..... 173
Nebular Theory..... 391, 428
Negations no Ground of Science ..... 179
Nebulæ Disproved ..... 402
Negative Evidence inconclusive ..... 336
Nelly's Cove ..... 291
Neptunists ..... 30
New Holland ..... 325
New Quay ..... 291
New Walks in an Old Field ..... 17
Newton, Sir I. ..... 89, 112
Newtonian System ... 93, 139
Niagara Falls ..... 338
Noah's Deluge..... 88

O.

Ohio Extinct Animals..... 340
Old Red Sandstone..... 17
Ontario Lake ..... 339
Oolite ..... 319
Order of Succession..... 365
Optics, Newton's ..... 124
Owen, Professor 149, 327, 421

P.

Palæozoic Rocks..... 277, 343
Paley ..... 198
Partial Formations..... 320
Peat Bogs ..... 297
Peat and Coal..... 298
Pebbles, rolled and other 210, 219
Pembroke Strata... ..... 49
Permian System ..... 41
Petrifaction Sudden ..... 58
Philosophy, its Limits..... 149
Phillips, John ..... 343
Picturesque Sketches ..... 394
Planets without Atmosphere ..... 403
Playfair ..... 112, 254, 268
Plesiosaurus ..... 422
Plutonists ..... 30
Police of Nature..... 133
Pompeii ..... 87
Porphyry..... 240
Port Halla ..... 290
Portland Dirt Bed ..... 296
Precession of Equinoxes... 141

Principles of Geology ..... 17
Probability ..... 126
Progressive Development not founded on Fact... 421
Providence of God ..... 95

R.

Rainbow after the Flood 88
Rain Drops in Stone ..... 205
Raised Beaches ..... 291
Resurrection of the Body 86, 369
Revelation ..... 78, 173
Riffleberg Peak ..... 233
Rock of Gibraltar ..... 34
Rogation Days ..... 321
Rolled Pebbles ..... 210
Roofing Slate ..... 229
Rosse, Lord, his Telescope 402
Ross, Formation ..... 22
Roy and Mudge ..... 233
"Royal George" ..... 87, 421

S.

Sanchoniatho ..... 76
Scoresby ..... 115
Scriptures Invalidated..... 24
Scripture all Connected ... 127
Scriptural Record of Creation ..... 349
Secondary Strata..... 52
Sedgwick, Professor ..... 29
Shakespeare's Cliff ..... 46
Shark ..... 422
Shells, Fossil ..... 32
Shells on Snowden ..... 62
Sheppey Beds..... 35
Shingle ..... 291
Silurian Rocks ..... 22, 41
Skirrid Hill..... 256
Slates ..... 230
Slaty Structure ..... 233
Slope of Glaciers..... 108
Smith, Dr. Pye ..... 226
Smith's Classification of Strata by their Fossils 34, 143
Snowden ..... 62, 102
South Wales Strata..... 49
Southern Coast ..... 273
St. Paul's Cathedral..... 22
Straits of Dover..... 322
Strata once Continuous and Horizontal ..... 69
Strata Calcareous ..... 42
Stratification ..... 40
—— Ordinary..... 54
Strata Destitute of Fossils 322
Strzelecki ..... 253, 325
Submarine Forests ..... 292
Suffering not Needlessly inflicted ..... 371
Suffolk Crag ..... 336
Supernatural Deluge 28, 174

T.

Taautes ..... 77
Tay Basin ..... 294
Temperature of Mines..... 114
Tenby Strata ..... 49
Theology and Philosophy are in Harmony..... 146
Theories Old and New ... 27
Theory not easily given up ..... 29
Tilestones and Slate ..... 234
Tilgate Forest..... 54
Transit of Venus..... 403
Transported Blocks..... 107
Trees Imbedded..... 296
Tycho Brahe ..... 140

U. V.

Vagueness of Statement... 400
Van Diemen's Land 253, 325
Verneuil, M. De..... 341
Vestiges of Creation 139, 193
Uniformity in the Laws of God ..... 97
Uralian Mountains..... 23
Vulgar Errors..... 207

W.

Wealds of Kent ..... 46
Wealds of Sussex ..... 54

Webster's Diagram..... 61
Werner ..... 254
Wernerians ..... 30
Whitby Fossils ..... 55
Wisdom Divine ..... 112, 378
Woolaston, Dr. ..... 403, 428
Word of God ..... 376
Word of God and Works coincide ..... 95
Working Men, Advice to, 18
—— Opportunities..... 21
World, Cosmos, Aion..... 376
Worlds made by Christ... 379
Wrekin Hill ..... 256, 267
Wye River ..... 309

Y.

Young, Dr. T..... 362

# CHAPTER I.

1. The Old Red Sandstone; or, New Walks in an Old Field: by Hugh Miller.—2. Principles of Geology: by Charles Lyell, Esq.—3. A Memoir on the Flat Regions of Central and Southern Russia in Europe: by Sir I. Murchison, M. de Verneuil, and Count Keyserling.

The book which stands first in the above heading is a remarkable production. It is by a working man, who, making a right use of opportunities within the reach of all, has raised himself above the condition in which he was born, and produced a book which is likely to be remembered on many accounts. We know nothing whatever of Mr. Miller beyond what may be gathered from his book; but from this it is evident that he has lost no opportunity of cultivating a naturally vigorous mind, and has brought it to bear in a practical, common-sense way upon every thing which has fallen within the range of his observation; and he states that his chief motive for publishing was, that the working man might be encouraged by his modicum of success to improve every opportunity for observation, since "it cannot be too extensively known that nature is vast

and knowledge limited, and that no individual, however humble in place or acquirement, need despair of adding to the general fund." The opening remarks, on the "working man's true policy," are well worth the attention of all young men; for all desire, in one sense or another, to better their circumstances.

"My advice to young working men, desirous to better their circumstances, and add to the amount of their enjoyments, is a very simple one. Do not seek happiness in what is misnamed pleasure: seek it rather in what is termed study. Keep your conscience clear, your curiosity fresh, and embrace every opportunity of cultivating your minds. You will gain nothing by attending Chartist meetings: the fellows who speak nonsense with fluency at these assemblies, and deem their nonsense eloquence, are totally unable to help either you or themselves, or, if they do succeed in helping themselves, it will be all at your expense: leave them to harangue unheeded, and set yourselves to occupy your leisure hours in making yourselves wiser men. Learn to make a right use of your eyes: the commonest things are worth looking at—even stones and weeds, and the most familiar animals. Read good books, not forgetting the best of all: there is more true philosophy in the Bible than in every work of every sceptic that ever wrote, and we would be all miserable creatures without it, and none more miserable than you. You are

jealous of the upper classes; and perhaps it is too true, that, with some good, you have received much evil at their hands. It must be confessed they have hitherto been doing comparatively little for you and a great deal for themselves. But upper and lower classes there must be so long as the world lasts; and there is only one way in which your jealousy of them can be well directed. Do not let them get a-head of you in intelligence. It would be alike unwise and unjust to attempt casting them down to your own level, and no class would suffer more in the attempt than yourselves; for you would only be clearing the way, at an immense expense of blood and under a tremendous pressure of misery, for another and perhaps worse aristocracy, with some second Cromwell or Napoleon at their head. Society, however, is in a state of continual flux; some in the upper classes are from time to time going down, and some of you from time to time mounting up to take their places—always the more steady and intelligent among you, remember; and if all your minds were cultivated, not merely intellectually, but morally also, you would find yourselves, as a body, in the possession of a power which every charter in the world could not confer upon you, and which all the tyranny or injustice of the world could not withstand.

"There is none of the intellectual and none of the moral faculties, the exercise of which does

not lead to enjoyment; nay, it is chiefly in the active employment of these that all enjoyment consists; and hence it is that happiness bears so little reference to station. It is a truth which has been often told, but very little heeded or little calculated upon, that though one nobleman may be happier than another, and one labourer happier than another, yet it cannot at all be premised of their respective orders that the one is in any degree happier than the other; simple as the fact may seem, if universally recognized, it would save a great deal of useless discontent, and a great deal of envy" (p. 27).

Mr. Miller illustrates his meaning, and strengthens the counsel he gives, by a brief but very interesting account of the commencement of his own career as a slim, loose-jointed boy, set to work in a quarry; and there finding, to his surprise, not only that the labour was no great hardship, but that this which was apparently mere drudgery opened to his observation numerous facts, imparting a lasting pleasure to himself, and ultimately conveying important instruction to others; so that a simple quarry man was thus enabled to better his own circumstances, and also to enlarge our stock of knowledge and benefit science itself.

"My first year of labour came to a close, and I found that the amount of my happiness had not been less than in the last of my boyhood. My knowledge, too, had increased in more than

the ratio of former seasons; and, as I had acquired the skill of at least the common mechanic, I had fitted myself for independence. The additional experience of twenty years has not shown me that there is any necessary connexion between a life of toil and a life of wretchedness; and when I have found good men anticipating a better and a happier time than either the present or the past, the conviction that, in every period of the world's history, the great bulk of mankind must pass their days in labour, has not in the least inclined me to scepticism.....One important truth I would fain press on the attention of my lowlier readers. There are few professions, however humble, that do not present their peculiar advantages of observation: there are none, I repeat, in which the exercise of the faculties does not lead to enjoyment."

The remarks of a working man have one advantage over those of men of science—that they result from a longer and closer acquaintance with the subject, and are experimental rather than theoretic. The observations of the workman result from his work. The mason distinguishes the quality of the stone because its durability depends upon its quality; and he remarks its joints and cleavage, as by attending to these things, or the grain of the stone, the work is facilitated and the building improved. St. Paul's cathedral seldom wants repair, because the stone was well chosen, well wrought, and

rightly placed; Blackfriars Bridge is continually needing repair, because these things were neglected. And as Mr. Miller observes—"The amateur will often pronounce a formation unfossiliferous, when, after the examination of a few days, he has not discovered any organic remains; half the mistakes of the geologists arising from conclusions thus hastily formed. But the working man, whose employments have to be carried on in the same formation for months, perhaps years together, enjoys better opportunities for arriving at just decisions. There are formations which yield their organisms slowly to the discoverer, and the proofs which establish their place in the geological scale more tardily still. I was acquainted with the old red sandstone of Ross and Cromarty for nearly ten years ere I had ascertained that it is richly fossiliferous—a discovery which, in exploring this formation in those localities, some of our first geologists had failed to anticipate: I was acquainted with it for nearly ten years more ere I could assign to its fossils their exact place in the scale."

It is to this very extensive formation, which holds a place between the mountain limestone of the coal districts, and the gneiss, grauwacke, and clay slate, of the transition series, that the attention of geologists has been especially directed of late: first in the Silurian rocks bordering Wales; next in the Devonian rocks abutting upon Dartmoor; and, lastly, in the most exten-

sive deposits of the same rocks throughout the southern districts of European Russia, abutting upon the Uralian mountains; all of which have been carefully examined by Sir I. Murchison, to whom Mr. Miller dedicates his book, as having encouraged him in the prosecution of his researches, and assisted him in his enquiries with advice.

The facts which have been thus made known are of such importance as to shake the theory of successive destructions and new creations to its very foundation—to make it necessary that the whole theory should "be greatly modified before it can be admitted—before we can receive it as an universal truth." And we, therefore, think this a favourable opportunity for bringing the whole theory of the geologists under review at once; that while they are acknowledging error in one point, and endeavouring to correct it, they may also re-examine the other weak points of their system, and either amend it, or, if not capable of correction and explanation, abandon it altogether.

And as Mr. Miller has very properly counselled the working classes to exert themselves, and not to let others get a-head of them in intelligence, so it behoves the scientific not to let others get a-head of them; and it behoves the clergy, above all classes, to take care that the laity do not get a-head of them; for the days are gone by when the word of a clergyman would

pass for Gospel. The clergy now must make themselves acquainted with the pursuits and studies of the laity to meet their wants and solve their difficulties. And there is no one pursuit so much in danger of being perverted to infidelity as geology, and therefore none which it more behoves the clergy to understand in order to guard it from this perversion; and this is our reason for examining the question pretty fully on the present occasion.

And since it cannot be expected that working men will be very deeply versed in science, yet scientific knowledge is required in discussing the points involved in the geological theory—the clergy, who, from their education and leisure, are for the most part able to acquire this knowledge, may save the working classes from being misled by the specious appearances of science on which the theory rests; and the most dangerous part of the theory is that which the clergy are best able to understand, and can most effectually meet and expose: it is that part of it which professes to reconcile the theory with the Scriptures. This attempt at reconciliation is not undertaken with any dishonest intention—it is meant in good faith, and undertaken in sincerity, and is received in all simplicity by the humbler classes. But those who are well-informed in the Scriptures and in theology will perceive how entire a failure there is in the argument, and how impossible it is to produce

such a reconciliation, save by a sacrifice of one part or other of the word of God. And in Mr. Miller's book we have an instance of exactly that which we mean; for he, no doubt with sincerity, recommends the Bible to the working man as the best of books, and containing most of true philosophy; yet he himself has adopted those very opinions of the geologists which would subvert the credibility of Scripture, and place it as completely on a level with any scientific treatise as the veriest infidel would desire. We are sure that it would grieve and offend Mr. Miller to be told so, and that he, as well as Dr. Buckland and the other clergymen who are professed geologists, will deem the accusation unjust and most uncharitable. And we can only disclaim all intention to offend, and beg them to weigh what we say.

Mr. Miller, whose researches have been conducted chiefly in the old red sandstone, is naturally surprised that its contents should have been so long unknown, and even its existence as a formation very recently denied. To a foreigner, who said "you must inevitably give up the old red sandstone," Sir I. Murchison replied, "I would willingly give it up, if nature would, but it assuredly exists, and I cannot." Since this time such further acquaintance with his old favourite has been made by Sir I. Murchison, in the eastern parts of Europe, as will we doubt not attract Mr. Miller's attention. It is possible that we

may find the geologists as confident against what we can say as the foreigner was against the existence of the sandstone formations; and yet they may ultimately become convinced, as we hope the foreigner is by this time. And as the sandstone itself is a strong illustration of the principles for which we contend, this may tend to procure a more favourable hearing from these gentlemen for principles of science which we believe to be as indisputable as the existence of sandstone.

The geologists have no hesitation in ascribing to all those who question their theory *at present*, all those prejudices and defects which have been unsparingly heaped by them upon the *old geologists*—the construction of theories in ignorance of facts and of the true principles of science—the adoption of such theories without examination—the combining opposite theories without regard to their contrariety—and continual prepossessions in regard to the duration of past time—all which circumstances may have warped their judgment, and given an undue bias to their opinions. The geologists are, therefore, bound to submit to the same ordeal, and must expect to be weighed in the same scale. All *their* opinions must be so scrutinized as to deprive them of all undue bias—we must guard against *their* prepossessions—and, above all, insist upon having facts produced in support of every assertion, and a close conformity with facts, and with

the acknowledged principles of science in *the new theory.*

When it is shown that an *old* theory is faulty or absurd, we are quite right in rejecting that theory, but we are not therefore obliged to find out or to adopt some *other* theory. It may be that we have not facts enough to found any theory upon—it may be a subject beyond our reach and out of the sphere of our comprehension. And the talent to demolish is not always such as can also construct; the man who detects faults in another is very often blind to the same kind of faults committed by himself; and the modern geologists must not be outrageous if they find themselves in company with their elders—if they find themselves committing faults which are in principle the same, and changed only in circumstances.

In one respect the older geologists, at least the great majority of them, were quite agreed with those of the present day; they considered precipitation from a mechanical solution to be sufficient to account for such deposits as contain organic remains; and they also agreed with the moderns in supposing that such processes as those by which the rocks were at first formed have been going on to the present day. But the older geologists supposed that the deluge of Noah was the time during which this precipitation took place on the high lands, which deposits they thought were consolidated to their

present degree by the retiring of the waters. Whereas it does not appear that the modern geologists attribute any noticeable effects to the deluge of Noah, ascribing each stratum or deposit to a distinct deluge; the last of which catastrophes took place, according to their hypothesis, long before any recorded era—long before the creation of man. In one respect the older geologists were more consistent than the moderns are; for though they maintained that mechanical solution and precipitation provided the materials of stratification, they believed that an extraordinary agency, a supernatural deluge, was needed to provide sufficient materials, and to raise them to their present places. Whereas the moderns suppose not only that the agency for preparing the materials, but also for raising them to the positions they now occupy, is an agency still going on; that no part of the agency is supernatural. And their inconsistency lies in this, that, appealing as they do to facts, and professing to account for all things by ordinary operations, they cannot show an instance of any one stratum formed by that agency to which they attribute the formation of all: and all formations are thrown back beyond the bounds of time, to an epoch in which the six thousand years of our chronology is as an undiscernible atom, yet they use the phenomena around us to measure and calculate this antemundane immensity. And they have really no data whatever for doing so.

They have mud at the bottom of lakes, they have slime on the banks of tide rivers mixed with sand-bars at the mouths, and they have the shingles, and comminuted shells, and uncohesive sands on the sea-shore, but they have no further facts: the mud, shingles, and sand, for anything we know, may be mud, shingles, and sand to all eternity. There is not a step taken towards the consolidation of any of these, and the assertion that they will become in the course of time solid strata by any process now going on must be treated as an assertion purely hypothetical.

Professor Sedgwick observed long ago, respecting geology, that the rival theories would do no real harm to science, if men could abandon a theory with as little difficulty as they felt in embracing it: but since a theory necessarily gathers round it the facts concerning that science which it professes to explain—so reducing them into principles, and ranging them under elementary heads, as to form one system—we are not only reluctant that this should be disturbed from the dislike we feel to the trouble of acquiring a new arrangement, but we resist every assault upon the theory, as if it were an attempt to despoil us of science itself. And when we know that the theories thus adopted were originally framed by men of great practical knowledge, and have since received the sanction of others of great repute in science, we are tempted to regard

the humble remonstrance of any less eminent man with the contempt and scorn due to an arrogant pretender.

While the geologists were divided into the two great classes of Plutonists and Neptunists, the opposite theories of fire and water saved the contending partizans from becoming so built up in their own positions on either side as to think them impregnable; the opponents could not claim a monopoly of science on either side, and equal talents were put forth in assaulting and repelling. The disgrace attending even a defeat was very tolerable; to change sides was small dishonour; to rank with the followers of Hutton and Playfair was not considered, in a follower of Werner, to be an abandonment of science. But now the geologists have taken another position in maintaining which they all agree—a position so wide as to give room for both the preceding parties; to allow them to meet without clashing, and in their union, concentrating all the science, to become safe from all assaults, save the vulgar assaults of the uninstructed and prejudiced, which such men may wisely disregard.

The early geologists devoted themselves to the examination of local facts, to ascertain the circumstances under which each mineral might find its present place, and assume its present appearances. The Wernerians, in their examinations, were guided, first, by external and obvious

characteristics, and as all minerals indicate some kind of stratification, and some reference in their fracture to adjacent mountain ranges, as well as to the horizontal line, therefore *mechanical* action alone might in all cases suffice to explain the local facts. And the Wernerians classified the rocks according to mechanical principles of deposition—as primary, transition, secondary, tertiary, diluvial, &c., succeeding each other from the oldest to the newest. The Huttonians, on the contrary, attended more to the internal characters and constituent ingredients of minerals in forming their system; and as fire was the agent employed in their laboratories to resolve all the rocks into their primary elements, and as in many instances they were able to reconstitute them by the agency of fire, even in their small furnaces, so they supposed that all the minerals might have been formed, in the great laboratory of Nature, by the agency of fire alone.

The Wernerians were pre-eminently practical men; they collected abundant facts before they began to speculate, and their theories were in strict agreement with the facts; and, therefore, they limited their system to the countries they had examined. The Huttonians were scientific men, and examined every fact in order to bring it under some law; the theory of these last preceded their collection of facts, and was continually tending to overpass and overbear the

facts. The theory of fire agency of course *reversed* the order of succession as to primary, secondary, and tertiary rocks; as the fire acted in the bowels of the earth and formed the strata from beneath, in a *descending* order: but the water acted on the surface of the earth, depositing the strata from above in an *ascending* order. In favour of the aquatic origin of strata, it was alleged that shells and corals were found universally, and to the tops of all but the highest mountains, and forming constituent ingredients of all formations save the primitive. And in favour of the igneous origin, we were referred to the many indisputable indications of heat amounting to fusion, and volcanic heavings, and rending of the strata; and, above all, to those phenomena which, like granitic veins, must have proceeded from an upward pressing of the crystaline rock, while in a state of fluidity or lava-like fusion. And these things led to a sort of amalgamation of both theories into one system, in which the joint agency of fire and water were admitted, before the accurate notices of the animal remains peculiar to the different strata had brought into the enquiry the new element of time, which has since become the most striking feature of the science, and the point to which geologists have given most attention.

From the earliest times shells had been observed, and were taken for a proof of the deluge; and large bones had also been observed, which

were called bones of giants, or dragons, or dun cows, according to the local superstitions of the vulgar. But, when comparative anatomy came to be studied, it was found that these fossil bones scarcely ever were remains of such animals as can now live in our northern clime, often remains of animals not at present known, often of such as there is great reason for supposing to be now extinct; and among them all not a fragment had been found which ever formed part of a human body—a deficiency which excited most marked attention from the first, and which has not been as yet supplied.

As from the presence of shells and marine remains on the mountain-tops men had inferred a general deluge, so from the absence of human bones in the vast quantities of animal remains, they not unnaturally inferred that those animals had existed before the creation of man, and the more confidently, as many of the animals belonged to genera and species which are believed to be extinct. This second inference, from the absence of human bones, may serve to show that the pious conclusion derived from the presence of shells was somewhat rash; but both together ought the more to warn us against being too confident in the sceptical conclusions which have been deduced from the absence of human bones. For a negative argument is at best a weak position, and may be turned by a single discovery of a single fragment; and needs, moreover, in this

instance, the proof that human bones are capable of fossilization, like the bones of animals and the shells of fishes.

While these more accurate examinations of each specimen were going on, men were also observing their relative positions in the strata and beds which respectively contain them. And it was soon discovered that although some strata consisted of vast masses of shells and corals heaped together promiscuously, as if by a deluge, yet in any one specimen, and the stratum to which it belonged, there was some predominant characteristic to distinguish it from other strata, and there was often some one species of shell or plant found no where else. And as these observations came to be made in distant regions, a curious interchange was observed, so that the fossil ferns and heaths of England were tropical species; the fossil plants of America, European; our fossil shells, mostly Asiatic; elephants on the shores of the Frozen Ocean up to the North Cape, and bears and wolves in the Rock of Gibraltar.

The observation that each stratum has its characteristic fossils, was first verified and methodised by Mr. Smith; and his remarks applied principally to the chalk deposit, and the strata connected with it, above and below. But the principle thus established in one series was found to prevail through all the stratified deposits; so that by merely seeing the shell or bone,

a geologist was able to declare with confidence from what part, in the long series of stratification, this specimen came. A higher value and far greater precision was given to the observations of Mr. Smith by the skill of Baron Cuvier, so unrivalled in comparative anatomy, and that of M. Agassiz in ichthyology; who, bringing their own peculiar acquirements to bear on the facts brought into notice by Mr. Smith, determined, beyond the possibility of contradiction, the distinctness and order of the various strata, and also that the fossil remains were not of such animals as are at present known upon the earth.

Of these fossils it may suffice in general terms to remark, that they are most imperfect in the oldest or transition strata, being there only casts of bivalves, of distorted form and of very few species; that in the slates and shales, ferns and palms most abound; with the red sandstone and mountain limestone, corals, madrepores, and trilobites are associated; with the newer sandstones and the oolitic limestones, nautili and cornua ammonis come in, and in the lyas beds of this formation, the gigantic ichthyosauri; while the chalk is characterized by echini of various species, passing into the slightly differing echini and bivalves of the upper gravel, and the oysters, whelks, and nautili of the London clay, and the junks, fruits, and land animals of the Sheppey beds.

While these observations were in progress,

some most important experiments, by Sir James Hall, proved the possibility of converting amorphous substances into perfect minerals by means of heat; as chalk into limestone, sand into flint, and sawdust into coal; which experiments the Plutonists regarded as a triumphant demonstration of their theory. But other experiments were conducted by Chenevix, Hatchett, and Sir Humphrey Davy, which were subsequently carried to a greater length by Mr. Crosse, affording equal gratification to the Neptunists, as they proved that, by the application of galvanism to an aqueous solution, it was possible to obtain crystals and stones, no less perfect than those obtained by the application of heat in the preceding process. Geologists, therefore, concluded, that having found the order of the strata as above, and having, through these double experiments, the command of both fire and water *ad libitum*, they might get up a very pretty theory, and account for all things in a very plausible way. Water being the most simple, they might push that as far as it would go, quite sure that they would not burn their fingers; when water failed, fire was at hand to carry them a little further, or, at all events, to raise a smoke; and if fire and water should both fail, there were earthquakes and volcanoes for a last resort, which furnish a safe retreat for every hard-pressed geologist, as they appear to have no law, and are veiled in impenetrable obscurity.

A tone of ridicule is not that which is suitable to a scientific discussion, because we expect that scientific enquiry, and the systems deduced from those enquiries, will be solid, rational, and conclusive; but the geological system is so utterly at variance with common sense, if brought to bear on the sciences involved, in their merest rudiments, that it cannot but excite ridiculous emotions to behold grave men, in all the pomp and pretence of learning, pursuing the strange vagaries of such an *ignis fatuus;* and playing their pranks over the quagmire of infidelity, without being aware of the gulph which quivers beneath the ground they tread. One can but laugh or weep.

The train of reasoning among the geologists is this. No human bones are found in the strata —*ergo*, the strata were formed before the creation of man. Each stratum is distinct from every other stratum—*ergo*, each stratum is a distinct act of creation, and all in an approximately ascertainable succession of periods dependent upon our present knowledge of the increase of animals, and of the time it would now take to deposit strata of that thickness! An accurate thinker would not need to go further than this to perceive the flimsiness of the whole, and would apply the poetic adage, *Nec Deus intersit nisi dignus vindice nodus.* A sweeping argument is drawn from the non-discovery of human bones, and then assumed as an axiom for the basis of

all the rest. Then it is assumed that each stratum is universal, and once formed the sole and entire superficial covering of the earth, the whole earth being at that time inhabited by no other animals than those which are imbedded in that stratum. Then God is supposed to come in, to make an end of that race of animals, which they therefore call extinct; and to create the next race, to be in like manner destroyed and imbedded in the next superincumbent stratum! But whence comes the stratum to imbed them? —must not this be created too? It cannot come from the last or precedent stratum, because in that case it would contain the *same* fossil remains washed out of it, and the *same* ingredients, as being formed from the detritus of the same materials: but this would contradict the very argument itself, which assumes that they are distinct, both in animal remains and ingredients!!! And it is a very sorry and purposeless work to suppose God engaged in creating only to destroy, for such countless generations, and such innumerable ages; and all *before* man had sinned, and the creation was cursed for his sake—before the creature became "subject to vanity, not willingly, but by reason of him who subjected the same" (Rom. viii. 20).

Such general objections to the reasoning of the geologists have quietly settled the argument in the minds of many, and these think no more of them or of their system. But for this very

reason such objections do not reach the geologists themselves, and if they did, a refuge would be at hand in the details of the system; which, by the help of a little shifting and shuffling, with a seasonable earthquake or volcano, may seem to stop, or parry, or evade the force of every general objection. But obstacles in detail, and that of a most formidable kind, have recently occurred, on which the whole system is in a fair way of suffering shipwreck.

These details are really inconsistent with the general argument; but such an objection is a mere trifle with the geologists—an earthquake will reconcile all. In the details they cannot assert that *any one* stratum is universal, or prove that any one ever was universal, though the general argument assumes that *all* were once so. The frequent parallelism of hundreds of strata together requires that these, one and all, should have been quite horizontal, to be thus regularly deposited, according to their theory; and then one and all raised to their present degree of inclination, or dip, as it is called, by an earthquake—that most accommodating, because most irregular, friend in need. So far, so good; the strata were deposited horizontally, and raised at one end or depressed at the other, as the circumstances may require, by an earthquake. But each stratum, they say, was thus deposited separately, and then each was raised to drain it, in preparation for another deposit; and each, when

drained, brought down a second time to the horizontal position, that the second deposit may be parallel with the first, and so in succession, alternate draining and deposition, for every stratum of the series. The earthquake does his part quite genteelly—he raises the strata very civilly, however many they be, and as soon as they are at the dry point, lets them down again quite easily, and repeats this process as often as any geologist desires. Truly this is a very docile earthquake, and seems to have had as good a course of training as that notable lion who promised and vowed to roar as gently as any sucking dove, so that the ladies should all say, let him roar again!

The theory—which this accommodating earthquake was thus conveniently used to bolster up, by lifting up strata of a mile or two in thickness, and of some hundreds of miles in length, and letting them down again with all the ease and regularity of the lid of a box, or the leaves of a book—received a very severe shock by the anomalies discovered in Dumfries, Hereford, and Devon—anomalies which had not been foreseen, and to which the earthquake could not be accommodated. And Sir I. Murchison's recent discoveries in Russia will oblige us, however unwilling, to send the earthquake about his business elsewhere, for there is no place for him here—there is no work at all for him to do.

Sir I. Murchison asserts that the stratification

examined by him in the government of Perm is unquestionably the old red sandstone, and has the known characteristics of the Silurian and Devonian strata; yet that in the Permian system the strata are evidently undisturbed, and are still, as from the commencement of this deposition, perfectly horizontal, yet each stratum is quite distinct from the others, as distinct as if our kind friend the earthquake had intervened to distinguish them; so that now the earthquake must go overboard—must be kicked off like an old shoe.

The next point in the geological details which involves a principle is that which accounts for the ingredients of the strata—the materials of which each stratum is made up. On this it is maintained that each succeeding stratum is formed from the detritus of pre-existent strata, or of the rocks from which those strata were formed: so that, in fact, all strata, without exception, have been formed from the detritus of the primitive rocks. This may not require that the ingredients of the primitive rocks should be found in *the same proportions* throughout the derived strata; but it does require that there should be *some correspondence* between them, and certainly that there should not be large masses of derivatives wholly untraceable to the supposed origin of these masses. We cannot bring this point to direct issue by taking adjoining rocks; but, if the principle be true at all, it is applicable

to all strata, and we would therefore try the issue between the granite, the most abundant primitive rock, and the newer limestone and chalk, the most abundant of the stratified. Limestone and chalk occupy about one-eighth of the surface of the earth, and is that deposit which is the most clearly marked and most uniform of all. It consists almost entirely of lime, save where bands of chert and nodules of flint intervene, and these are evidently distinct concretions, gathered into the mass while it was in a liquid state, and are not to be regarded as ingredients of the stratum, or as derived from older rocks, if such had furnished the said ingredients; the stratum is almost exclusively pure chalk, or carbonate of lime. Now, is granite carbonate of lime? Is it anything like it? We know that it is not—we know that it does not contain a particle of lime which can be separated by any mechanical action, and that the quantity which can be extracted by chemical analysis is very small indeed—is as nothing compared with the enormous masses of limestone and chalk.

The geologists are practical men; they have been aware of this objection, and they have endeavoured to answer it. The objection is very fairly stated by Dr. Buckland, and he gives the best answer which occured to him. We do not think that a better can be given, but this is their affair: it is the best answer we can find:—

"It is a difficult problem to account for the

source of the enormous masses of carbonate of lime that compose nearly one-eighth part of the superficial crust of the globe. Some have referred it entirely to the secretions of marine animals—an origin to which we must obviously assign those portions of calcareous strata which are composed of comminuted shells and coral-lines: but, until it can be shown that these animals have the power of forming lime from other elements, we must suppose that they derived it from the sea, either directly, or through the medium of its plants. In either case, it remains to find the source whence the sea obtained, not only these supplies of carbonate of lime for its animal inhabitants, but also the still larger quantities of the same substance which have been precipitated in the form of calcareous strata."

Such is the objection as stated by Dr. Buckland, and now follows the answer:—

"We cannot suppose it to have resulted, like sands and clays, from the mechanical detritus of rocks of the granitic series, because the quantity of lime these rocks contain bears no proportion to its large amount among the derivative rocks. The only remaining hypothesis seems to be, that lime was continually introduced to lakes and seas by water that had percolated rocks, through which calcareous earth was disseminated."—*Bridgewater Treatise*, p. 89, note.

Dr. Buckland is a practical man, and we ask him where are these rocks which must be per-

colated to form his hypothesis? They do not exist in the granitic series, nor in the sands and clays formed from the detritus of granite, even by Dr. Buckland's own showing: but these are the only localities where, *on the geological theory*, they could by any possibility exist; and every practical geologist knows that such rocks have no existence—that such an hypothesis has no basis—has no fact to rest upon; and is only brought in to blink an insuperable difficulty, and this in one of the fundamental principles of a system which pre-eminently claims the praise of being founded entirely on facts.

But, instead of a fact, we are treated with a volcano—that convenient friend to help a lame theory over a stile. For Dr. Buckland goes on to say that—"Although carbonate of lime occurs not in distinct masses among rocks of igneous origin, it forms an ingredient of lava and basalt, and of various kinds of trap rocks. The calcareous matter thus dispersed through the substance of these volcanic rocks seems to afford a magazine from which percolating water, charged with carbonic acid gas, may, in the lapse of ages, have derived sufficient carbonate of lime to form all the existing strata of limestone, by successive precipitates, at the bottom of ancient lakes and seas" (p. 90, note).

And it is stated that lava contains from 7.29 to 10. of carbonate of lime, the basalt of Saxony 9.5.

Now let us examine what these volcanic rocks will do for the theory—whether they can bolster it up on any supposition; and passing by the objection that the existence of such rocks is merely hypothetical and conjectural. It has just before been stated by Dr. Buckland that the mass of carbonate of lime to be accounted for constitutes nearly one-eighth part of the superficial crust of the globe—that is, if put into decimals 12.5; but the highest estimate of the carbonate of lime contained in lava is only 10.0: therefore, if the whole superficial crust of the globe, which is not carbonate of lime, were nothing but lava most highly charged with lime, it would not suffice—it would be still 2.5 short of the quantity required! And then what has become of the residuum—what has become of the lava out of which the lime had been washed?—a residuum which, taking the same figures for our basis, would be nine times as much as the carbonate of lime; while the surface of the earth is actually only seven times as much as the carbonate of lime, according to Dr. Buckland's own showing!

We are not only surprised that such palpable errors should pass unobserved, but also surprised that it should not be perceived that the having recourse to a volcano *at all* for the constitution of strata is, *ipso facto*, an abandonment of the whole theory, so far as *time* is a part of it. For all the arguments as to time rest upon the sup-

posed length of the periods which would be required to decompose the older rocks and reconsolidate them into the newer strata, *by mechanical laws still in action.* Volcanoes in their action, and lavas in their decomposition, cannot be brought under any law, and the introduction of such an element is tantamount to an opposite theory.

The objections which we have made to the explanation given are conclusive against it, even on the lowest estimate of the carbonate of lime, even as it now constitutes masses on the surface of the earth. But it is obvious that these masses were, many of them, once connected together, and that extensive denudations have taken place; such, for instance, as the whole district between Shakspeare's Cliff and Beachey Head, including the Wealds of Kent, Sussex, and Surrey, and lying between the North and South Downs to the borders of Hampshire. By the confession of all, many large tracts of such a description were once occupied by continuous masses of carbonate of lime, of equal thickness with the cliffs which bound these districts on all sides. And, according to the geological theory, the *whole earth* was covered by one such continuous mass during the carbonate of lime epoch: and thus not only are the objections increased in the ratio of the former enlargement of the deposit, but there seems to be no compatibility between them—no standing-place both for the lava and the lime:

the lime is said to be extracted from lava, for which lava itself no place can be found. It is putting the elephant on the back of the tortoise with a vengeance!

The same line of argument applies to every other distinct formation, as well as to that of the carbonate of lime; for it cannot be shown from whence, among the older rocks, materials of sufficient quantity, and of sufficient purity, could come to form the newer strata. The masses of clay slate among the transition rocks are as pure and as distinct as the chalk, and the crystalline marbles more so; nay, every stratum, and almost every bed, down to the silicious sandstone, and London clay, and ferruginous gravel, has sufficient homogeneity, to assure us that each has been formed under laws and conditions peculiar *to it, and it alone*, and not that all have been formed by one common process, from one common basis—the granite; not even with the supplementary help of lavas and other volcanic products.

Again: not only is there a failure in the sources from whence the materials for stratification are supposed to have been derived, but the agency assigned as sufficient to consolidate those materials into strata is insufficient for that end; and the situation and appearances of the strata are inconsistent with the supposition of any such agency: for if each stratum were separately formed by precipitation from an aqueous solu-

tion of its ingredients, the time required to form it being indicated by its thickness, and the consolidation which it acquired by time and draining having constituted its separateness; then would this consolidation resist its taking any other form and position than that in which it was deposited and consolidated—viz., the flat form and horizontal position. And where many strata are conformable, each stratum of that group must have been consolidated without any of them changing their position; for in any change they would be unconformable, since after the change the new succeeding deposits would continue to be horizontal. Now, since strata of contorted form, and raised to a very high angle of inclination, are of very frequent occurrence, we should expect that we might sometimes meet with a *single* stratum so raised, and unconformable with those above and below it, and at all times that this raising of consolidated strata would be attended with the *fracture*, never with the *bending*, of the horizontal slabs or strata of stone. But, on the contrary, singly raised strata are never found; and innumerable instances are met with of vast masses of strata, bent and contorted in all possible degrees, yet each cohering and not snapping, and all conformable with each other in these bendings and contortions: thus showing that, so far from each stratum being consolidated before the deposition of the next, the whole mass, sometimes consisting of hun-

dreds of strata, was in a plastic and cohesive state, so as to bear to be bent upwards to nearly a right angle, and in many instances for the strata to slide over each other, and curl and wrinkle in sliding, like sheets of wet paper sliding down an inclined plane. Such is the case along a great portion of the coast of South Wales, especially between Pembroke and Tenby; to the north of which last town the strata consists of a very hard silicious sandstone, with rock crystals on the upper surface of each stratum; yet these, which average from two feet to a yard in thickness, are bent, and have slidden in the manner alluded to.

In this question of the way in which strata were formed, the geologists deceive themselves, and mislead others, by not rigidly adhering to one mode of explanation—not perceiving that, by thus shifting their ground, they do really abandon their theory, and do confess it to be untenable. The basis of the geological argument is the assumption, that the laws now in operation upon the surface of the earth are those which have regulated all stratification, and that by studying those laws we can ascertain when, and under what circumstances, stratification has proceeded. These laws involve, first, the mechanical deposition of the strata; secondly, the universality of each deposit: for mechanical deposition is the only action *the time* of which we can calculate; and each deposit must be as-

sumed to have been universal, to ensure a *succession* of such strata, and get at a succession of time. By the introduction of fire, or of chemical agency, into neither of which can we take in time as an element, we so far weaken the arguments from mechanical deposition; and by any abandonment of universality we open the door for *simultaneous* deposits in *different* places, and so nullify the whole argument. Yet every treatise on geology speaks vaguely on these points. Dr. Buckland, for instance, speaks of "the origin of crystalline rocks, which the common consent of nearly all modern geologists and chemists refers to the action of fire;" and says "there is little doubt that the fluid condition in which all unstratified crystalline rocks originally existed was owing to the solvent power of heat." Yet, in another place, he so qualifies the agency, both of fire and of water, as to render it impossible for us to bind him down to either. "The state of the ingredients of crystalline rocks has, *in a great degree*, been influenced by chemical and electromagnetic forces; whilst that of stratified sedimentary deposits has resulted *chiefly* from the mechanical action of moving water."

When rocks are said to owe their original existence to any power, this is a tangible proposition, and we may grapple with it; but when it is afterwards broken down to their being influenced *in a great degree* by such a power, or another state has resulted *chiefly* from a certain

action, the expressions may mean anything or nothing, for they are too vague and indefinite to lay hold of; and when he would draw out in detail the succession of formations, from the crystalline to the sedimentary, there is the same vagueness of statement, and the same eking out one agency by bringing in another. For, speaking of the elements rendered fluid by heat at the beginning, Dr. Buckland says—

"From this fluid mass the first granitic crust appears to have been formed, and subsequently broken into fragments, disposed at unequal levels, above and below the surface of the first formed seas. Wherever solid matter arose above the water, it became exposed to destruction by atmospheric agents—by rains, torrents, and inundations, at that time probably acting with intense violence, and washing down and spreading forth in the form of mud, and sand, and gravel, upon the bottom of these existing seas, the materials of primary stratified rocks, which, by subsequent exposure to various degrees of subterranean heat, became converted into beds of gneiss and mica slate, and hornblende slate, and clay slate. In the detritus, thus swept from the earliest lands into the most ancient seas, we view the commencement of that enormous series of derivative strata, which, by long continued repetition of similar processes, have been accumulated to a thickness of many miles."

And, to account for the elevation of these pri-

mary strata, the granite peaks are supposed to have risen and forced up certain portions of these strata:—

"Corresponding formations of primary and transition strata are represented as occurring on each side of this elevated granite, which is supposed to have broken through, and to have carried up with it to their present elevated and highly-inclined position, strata that were once *continuous* and nearly *horizontal*."

And concerning the succeeding formations—"The secondary strata are composed of extensive beds of sand and sandstone, mixed occasionally with pebbles, and alternating with deposits of clay, and marl, and limestone. The materials of most of these strata appear to have been derived from the detritus of primary and transition rocks; and the larger fragments, which are preserved in the form of pebbles, often indicate the sources from which these rounded fragments were supplied."

In all which there is the same shifting of the ground, and a continual bringing in of other agency, under a secret consciousness that the agency assigned is not sufficient. For when the granite peaks are lifted above the first formed seas, the theory affords nothing for their demolition, in order to form the strata, but *atmospheric agents*—rains, torrents, and inundations; and this conscious insufficiency of the agents is eked out by a *probably*—at that time *probably* acting

with *intense violence.* And having by this probability obtained the semblance of a sufficient quantity of mud, and sand, and gravel, and yet nothing but the water which had demolished them to reconsolidate them; and it being hard to believe that the same agent could produce contrary effects on the same materials; therefore "*various degrees of subterranean heat*" are brought in, which of course they claim the liberty of *varying* as much as they please, and would not, perhaps, like to define too exactly as subterranean; since the mud has only as yet got to the bottom of the sea, and the sea itself has a bottom of consolidated granite, through which we do not well see how the heat could come to the mud. And, above all, we have here the strata, one and all, resolved into detritus of the granite, which we have already shown to be the supposition of an impossibility, as the granite does not contain the ingredients.

Moreover, we again think it necessary to remind our readers that the fundamental point of the whole theory is this: that by the agency *now at work* in the earth they can account for stratification, and *therefore* have it in their power to calculate its periods, and to assert with such confidence a duration of millions of years. They must not be suffered to escape from the position they have chosen, and the ordinary agency now in operation, into the bowels of the earth, where it is very possible that, under confinement and

pressure, stony dust may, by the united agency of fire and water, become consolidated. For the subterranean agencies and all chemical or electromagnetic forces operate with such rapidity, or such inequality, as to render it quite impossible to deduce comparative time from them; and all the calculations concerning time in the geological theory rest solely on the supposition that stratification has taken place under *ordinary circumstances*—in such circumstances as we can now *observe*, and *watch* in progress, and *measure* in amount. They assert that the animals imbedded in the several strata lived upon the surface of each stratum until the time of its immersion, which being consolidated, the next stratum was first another surface, inhabited in like manner for a time, and then immersed and consolidated like the preceding—a supposition which they hold so confidently as to carry it out into all the collateral and ulterior consequences; such as inferring great changes of the climate from the plants and animals, when these last belong to tropical countries, and are now found imbedded in the colder regions. And some of the inferences drawn from these considerations are not a little curious; as when Dr. Mantell infers, from the iguanodons of Tilgate, that the Wealds of Sussex formed the estuary of a mighty river, with numerous tributaries, flowing through a country possessing a tropical flora, and inhabited by reptiles of appalling magnitude, and

of species which no doubt became extinct ere the creation of the human race; or, as when Mr. Hawkins, in contemplating the lias deposits of Whitby and of Lyme Regis, exclaims, how specious and imposing the ideas present with us, of a vast continent, sending forth a mighty stream, the solitary haunt of these voracious reptiles! So that we have three *mighty rivers* flowing in *opposite* directions within the compass of no vast continent, but of little England; and we have to travel no very enormous distances to ascertain the sources of each mighty stream, but should most probably find them in a place not very remote from the Chiltern Hundreds, or some such convenient abstraction.

And touching the extinct races of animals, which occupy so prominent a place in the argument of geologists, it is not a little remarkable that the most striking fact concerning them is slurred over, if not entirely omitted, in the argument. It is upon record that the carcase of a mammoth was discovered in Siberia, on the shores of the Northern Ocean, imbedded in ice, and thereby preserved from corruption; so much so, that the birds and beasts of prey came to feed on its flesh, when it had fallen from the mass of ice upon the sea-shore. Now, what does this fact prove? It proves that the catastrophe which overwhelmed this *extinct* animal was *the last* that had occurred, for there it has lain in its mass of ice undisturbed by any *succeeding*

catastrophe. It proves also that the catastrophe was sudden, overwhelming, and freezing up an animal which dwelt not amongst frosts and snows; and either its climate became all at once converted to the climate of Siberia, or it was so sealed up in ice, at the time of its destruction, that the atmosphere could not reach it to corrupt it, during transport, or at any subsequent period. It proves that no subsequent deposit has taken place on the surface of the earth; for there, on the surface of the earth, where it was then deposited, it has ever since lain. It proves that up to the very time, we might almost say the very day, when the earth took its present form of surface, and present constitution of climates, animals of the extinct race existed; and it bridges over that gulph which was supposed to be so vast between the present and the former world; it presents us with one of its extinct inhabitants all but alive, and it brings the era of the last of its races into contact with time, and within the roll of this world's generations.

Another proof that the operations, by which the stony crust of the earth was hardened, took place far more rapidly than the geologists suppose, is to be found in those foot-marks which occur at Dumfries, and in many other places on the upper surface of sandstone and other stratified rocks. These impressions prove that a living animal had just passed—that the stratum was soft enough to receive the impression of its

feet; but that before the tide had time to turn —before a shower of rain fell, the rock was indurated and the impression preserved. A single ripple of the waves, or a shower of rain falling, would obviously have obliterated marks which the yielding nature of the surface alone enabled it to receive. And strata such as these were not indurated by pressure under ocean depths, or by any of the various degrees of subterranean heat which the mind of man can conceive; nor did it require countless ages to form them, but each was hardened in about the same time as would be required to form such a sheet of ice.

The echini of the chalk strata furnish also conclusive proof of their petrifaction having taken place in a yielding mass, which became hard almost immediately after the echini were engulphed or embedded. It is evident that they were suddenly and violently swept away, from a large proportion of the shells being *crushed* against each other and against pieces of shingle; and the form still shows that there was the *elastic flesh* of the living fish within, only yielding to a certain extent, and keeping the crushed fragments of the shell in their places. Dr. Mantell, in many of his writings, has noticed this, saying —"Flints of the chalk strata, though now so hard and unyielding, must once have been in a state of softness or fluidity; for we have in them the most delicate markings of various echini, enveloped in the very substance of the flint, and

silicated. These remains are found in so perfect a state—the shells with all their spines and delicate processes so entire, that no doubt can be entertained that these animals were surrounded by the chalk while living in their native seas, and that many of them were entombed in their stony sepulchres *suddenly*, and while the rock was in a state of fluidity, like plaster of Paris. The chalk is stratified—that is, it is separated into layers or strata; and these as if a certain quantity had been precipitated, and had sunk to the bottom of the sea, and enveloped the animals which fell in its way, and this layer had hardened into stone before a fresh stratum was deposited. There is conclusive evidence that the flint and chalk were both dissolved or suspended in the *same liquid*, and that the two substances separated from each other (upon well known chemical principles) as they passed into a state of consolidation; the organic bodies serving as centres, around which the silicious matter concreted. Hence we find a coral, shell, or fish, partly embedded in chalk and partly in flint. And the chalk of the south east of England was deposited in the basin of a profound ocean; for the fossil shells, called ammonites, were inhabitants of deep waters, and these abound in the chalk."

With these observations of Dr. Mantell we entirely concur, save that the chalk may have been *thrown up* from a deep sea, carrying with

it the inhabitants of those waters; and all Dr. Mantell's facts would remain just as they are, and other facts would receive a better explanation.

The assertion which is most frequently and most confidently made is that just adverted to; and on it, in fact, the whole theory of the geologists mainly depends—namely, that all strata were formed at the bottom of the sea; and the proof adduced is, that the fossils embedded in the strata are marine productions, and often, as in the ammonites just mentioned, inhabitants of *deep seas.* But mixed with the ammonites, and in far greater numbers, we find also echini, which are not inhabitants of the deep, but of the shoal waters; these, they say, were washed down into the depths, and so got intermingled with the ammonites. But as there is no proof of this *washing down*, are not we at equal liberty to assert that the ammonites were *washed up* to the echini? If the geologists are right in their assertion, let them prove it, and by some better arguments than those by which Dr. Buckland endeavoured to show that chalk in sufficient quantity might be accumulated in the seas.

But the idea that stratification can be explained in this way, so as to agree with the facts, is perfectly absurd. For (not again to insist upon the improbability of an alternate raising and levelling of the strata, as must be assumed to produce their distinctness from each

other, though it amounts to an absurdity)—we say that to suppose the strata to be, by any means, or in any number, thus raised from the depths of the sea, is contrary to every fact and every principle, and is therefore perfectly absurd. Granting that the deposition of the strata be rightly accounted for; allowing the geologists to have their own way, until the last stratum was formed under the oceanic pressure; granting all this, though not proved, to come at the further point, of raising the strata from the bed of the ocean—we say that this further point cannot be proved, and is in all instances a mere assumption, and in many instances directly contrary to the fact.

Suppose the whole mass of conformable strata which constitute one formation to lie horizontally at the bottom of the sea, and that they are all to be lifted so as to become dry land, and many of them to be so raised as to produce the high angle of dip which we find; to accomplish this, it is evident that there must be a rising power applied, either *between* the stratified rocks and the crystalline, so as to raise the former, disjoin them from the latter, and submerge these last in the same degree as the former were raised; or such a power must be applied *beneath the crystalline* as well as the stratiform rocks, and so both would be raised together, and retain, when raised, the same relative position towards each other which they had before. Or, rather,

the granitic rocks could not be lower, and would generally be higher, than the others; as in lifting they would also protrude their pointed summits, and rise to a greater relative height than before.

The first of these applications of the raising power, so as to disjoin or intervene between the crystalline and stratified rocks, no one, we presume, will maintain, as the contrary is indisputably the fact. Therefore we assume that all geologists place that power, which raised the stratified rocks to their present height, so deep in the bowels of the earth, as to be, not only below the lowest deposits, but beneath those crystalline rocks upon which these deposits rest. In accordance with this, in all those plates which illustrate the principles of geology by diagrams, the granite is represented, not only as the basis on which the stratified deposits rest, but as rising into peaks, which break through the deposits, and lift the strata in rising, which strata become most highly inclined as they are nearest to the granite, the points of the granite rising far above them all. Such a diagram, drawn by Mr. Webster, is prefixed to Dr. Buckland's "Bridgwater Treatise."

But is this the case in nature? We think not. Cases certainly occur in which a granite peak crowns the summit of a mountain, seeming to burst through the secondary rocks which form the buttresses around its base: and a dia-

gram, which was designed to represent merely the order of the rocks and the proximity to the granite, would be quite correct in making the granite a pyramidal centre, and the other rocks as steps to the apex of the pyramid. This is not the point which we are here considering; we are considering, not the *order*, but the *mode* of formation, and are alluding to diagrams which are intended to represent universal facts, and an order which would be found universally, if local and accidental circumstances did not interfere. What we require to be shown is, that in *a district*, taken *as a whole*, and including all the stratified rocks of that district, the granite is the highest. Take, for instance, our own country, and examine the granite of Dartmoor: so long as we limit our observations to that spot, the granite is the highest, and would be correctly represented in a diagram as bursting through the other rocks. But continue the examination into Somerset, and cross over into Wales, you find no granite there, till you pass beyond Snowden, when granite re-appears: yet some of the stratified rocks of Somerset rise higher than the granite of Dartmoor; and Snowden, which contains shells imbedded in the strata to its very top, is more than double the height of the Cornish granite, and five or six times higher than the granite of Anglesea, which lies almost at its foot. A diagram for the whole western side of Britain should not represent the

granite highest, like the diagram of Dartmoor, but should represent the southern granite as 1,500, the northern as 600, and the secondary rocks of Snowden as rising to a height of 3,600 feet, between the two granites. Where, therefore, is the power which has lifted Snowden?

The same facts occur in that part of Scotland to which Mr. Miller's observations extend. "The old red sandstone of Morvheim, in Caithness, overlooks all the primary hills in the district, from an elevation of 3,500 feet." (*New Walks*, p. 49). And we doubt not that this would be found to be the rule, and the superior elevation of the granite to be the exception everywhere, if persons in their examination were wholly free from prepossession, and looked beyond the mere locality to the whole of a district.

And it should be remembered that we have only been speaking of that superior elevation which the granite ought to have in consequence of being *lifted*; and this, according to the geological theory, is only a second stage of elevation in the primary over the secondary rocks. For the theory supposes that the primary were *originally* higher, as they must of necessity have been if the secondary were formed by a detritus washed down from the primary: and thus, the primary ought to evince proofs *both* of their having been *originally* higher than the secondary, and also of that *additional* elevation which would ensue from their lifting.

Let not our readers suppose that we are denying the existence of a power sufficient to effect all that the geologists ascribe to it. Quite the contrary. We see proofs of such a power in the heaving and shaking of whole continents. But we assert that this power has not operated in the way that the geologists suppose; and that they are arguing from Tenterden steeple concerning Goodwin Sands. In geology there are two great classes of phenomena, which men endeavour to account for: there is the *orderly* class, of the regular succession of strata and the *uniform* nature of their contents; and there is the *disorderly* class, of the mighty convulsions, dislocations, and *bouleversment* of the previous order. All these phenomena the geologists ascribe to the same agency, and this is contradiction and absurdity.

We have collected materials for pursuing the enquiry into all its details, but this our space will not allow, nor is it necessary. The time is come, as we have already said, when the whole theory must be re-examined; we have sought to point out the false principles and the faulty observations involved in the old theory, and we can wait patiently for a better theory. We are not ourselves bound, nor do we think the geologists bound, to furnish a better; and we rather incline to the idea that more facts, and observations on a broader scale, and from more distant lands, are still wanting for the right adjust-

ment of all the parts of any theory, which shall stand the test of time, and be at all worthy of astronomy, or any of the sciences that rest on fixed principles.

Yet, though decidedly averse to theorizing in the present state of our knowledge, we think it opportune and becoming to indicate the principles which should guide others in endeavouring to account for and arrange the facts which geological enquiry is continually bringing under notice. The careful examination of facts and the diligent and impartial comparison of these different collections of facts, cannot but, in the long run, lead to the knowledge of all truth within our reach, and so subserve and promote the cause of religion. But hasty speculation does nothing but mischief, and most of all in the hands of religious men, who think they are, by crude and hasty speculation, advancing truth and godliness, when at best they are only indulging the imagination, and frequently even opening a door for unsuspected and insidious infidelity. And the same haste, which misapplies facts in turning them into crude speculations, may lead to a misunderstanding of Scripture, and so a misapplication of it, in support of a false theory. Geology may pursue its course, may collect its facts, may illustrate the facts by the principles of science, apart from theology, and without reference to Scripture. But this it has not done; on the contrary, geology has

become so mixed up with religion that we cannot now separate them, and must advert to the theology of the question; and the theology of the question is forced upon us by the writings of the geologists, some of whom so insist upon their discoveries as to deny any other mode of ascertaining the truth, and reject with scorn whatever is opposed to them in the Scriptures; others of them explain away the real meaning of Scripture in well meant but futile endeavours to reconcile statements *toto cœlo* opposed; and a still larger number speak of creation and extinction as if they were things of every day occurrence! —as if any one could create save God alone!— as if the very act of creation did not necessarily imply that God had done it!—or, most absurd of all, as if the creature could create itself! To take an instance of one beyond exception, as both a geologist and a clergyman, we quote Dr. Buckland:—

"The study of these remains will form our most interesting and instructive subject of enquiry, since it is in them that we shall find the great master-key, whereby we may unlock the secret history of the earth. They are documents which contain the evidences of revolutions and catastrophes long antecedent to the creation of the human race; they open the book of nature, and swell the volumes of science, with the records of many successive series of animal and vegetable creations, of which the creation and

extinction would have been equally unknown to us, but for recent discoveries in the science of geology" (p. 128).

Now there is one volume which we rank higher than the book of nature, or the volumes of science, and to the standard of which we would bring the book of nature, assured that where they differ we have not read the book of nature aright. We are sure that the Bible speaks of only *one* creation, and at the beginning—that it speaks of only *one* revolution or catastrophe, and at the deluge; and we, therefore, scrutinize narrowly that interpretation of the book of nature which professes to discover *many* creations and *many* catastrophes; and we assert that, on scrutiny, we find it to be manifestly erroneous—inconsistent with itself and with science; and therefore, even leaving the Bible out of the question, this interpretation cannot stand.

For these "many successive series of animal and vegetable creations" must be coupled with the theory concerning the formation of the strata, from which theory the evidence of *succession* is avowedly deduced. The theory assumes that each stratum was formed separately by means of a catastrophe which overwhelmed the pre-existent creation, broke up the older rocks into fragments, which subsided into a new stratum, which embedded all the living creatures then in existence; and new races were created when the new stratum was sufficiently consolidated for

their reception. The many distinct strata—each thus succeeding the other—each ushered in by an universal deluge, becoming the tomb of an entire creation, and itself then the subject of an entire new creation—is what they mean by the many successive series of creations and extinctions. Now we must pin the geologists to this, and mark the consequences.

The argument necessarily requires that each stratum containing these remains should have covered the whole earth to ensure *succession*, and that the catastrophe should have been universal to ensure *extinction*; as otherwise different strata might be formed *simultaneously* in different places, and some of the animals would have found refuge in the *undestroyed* parts of the earth, and so be found in *other* strata than those which they are said to distinguish and number.

And now let us take a few such strata, in order to see how the hypothesis will work; and we will take, first, the first stratum deposited upon the granite. We might grant that this first stratum was formed from a detritus of the granite, caused by the action of moving water, covering the surface of the whole earth; that the time required to form such a stratum might be indicated by its thickness; and that in the stratum thus formed might be imbedded the remains of whatever fish existed in that first sea. At the conclusion of the epoch, during which the first stratum was deposited, the "granite is

supposed to have broken through, and to have carried up with it, to their present elevated and highly inclined position, strata that were *once continuous and nearly horizontal*" (*Buckland*, vol. ii., p. 4). We wanted an account of the next stratum, and can only get all the strata in the lump; and it is by sweeping generalizations such as this that all the error has come in. But we will confine our attention to the next stratum, and will suppose that, in preparation for it, a catastrophe took place, or, in other words, an universal deluge, and a destruction of every living thing. How is this deluge to be brought about, and how is it to be got rid of? This is the question. A catastrophe suggests three ideas—a state of rest preceding, a state of convulsion during the time, and a following state of rest: during the preceding rest, however long it might be, only one stratum could be deposited; —the catastrophe might be accompanied with the raising of the granite, and so fulfil some of the required conditions, and explain some of the recorded facts; but in this it renders other indispensable conditions quite unattainable, and is contrary to a still greater number of facts; for the granite, once raised, *cannot* subside; the dry land, once appearing, an universal deluge *cannot* take place by any known and natural causes, for it would be contrary to them all; and it is by laws *now in operation* that the geologists profess to explain all these phenomena. To agree with

the geological hypothesis, the granite must subside, the first stratum must unbend and lie flat upon the granite to receive the second, and both must, in like manner, rise and sink to receive the third. And as there is no vacuum in nature, but every rising of the land is accompanied with a corresponding falling of the waters, there would be no possibility of producing an universal deluge by *natural causes* after the mountains were raised; it could only be done by cutting off the mountain-tops and casting them into the depths of the sea, to raise the waters; which no one pretends to have been the case. The deluge of the Bible stands on a different footing, for both its infliction and removal are ascribed expressly and exclusively to the finger of God. Here, therefore, the geological hypothesis breaks down, after the deposition of the first stratum, and leaves us without any means of accounting for the second; and they themselves virtually acknowledge it, in bringing in a new act of creation for each stratum. And they talk loosely and familiarly of creation and extinction, as if these were two of the laws of matter, like attraction and repulsion—as if these were laws now in operation, the progress of which we can watch, and measure, and weigh; when they mean no such thing, and when to both words they attach *two meanings*, and, between the two, shirk the exact and rigid application of either. For creation and extinction are not correlatives: the

proper opposite to creation is annihilation; but this would not serve the same turn. They mean creation proper—the bringing into being of new forms of life: they do not mean un-creation proper—the making those beings as though they had never been; but extinction of the life, without destroying the form: and the evil of improperly assorting such terms as creation and extinction is sure to extend to both terms. For though creation proper is the only meaning which truly agrees with their argument, since their extinction at each stage does mean the disposal of all the then existing creation in the stratum then deposited, and consequently to bring in the new inhabitants of the next stratum, there is absolutely nothing for it, in their theory, but new creation; yet they shrink from the idea, and would fain imagine that the germs of the new forms of being had been latent somewhere, in the air, or the sea, or the bowels of the earth, and were brought to light by chance, rather than by the power of God. Nay, even in the acknowledged *beginning* of all things, they will scarcely allow the proper meaning of creation, and often flatly deny it; as is the case of Dr. Buckland, quoting with approbation from Dr. Chalmers, as follows:—"Does Moses ever say, that, when God created the heavens and the earth, he did more, at that time alluded to, than transform them out of previously existing materials?" (*Bridge. Treat.*, p. 19). So then to

create is to transform! But what is gained by this? The previously existing materials must have, some time or other, been brought out of nothing!—must have been *created proper* when they began to be!—and what other time is this but the beginning—the time when God created the heavens and the earth?

It is sore and sorry work to say such things of such men as these; and we are sure they must be besotted by a foolish system, and that their hearts are guiltless of the mischief which such statements as these are calculated to produce: and, although the Hebrew Professor of Oxford has been also brought in, to give the weight of his authority on the same side, it is really not so much a question of Hebrew criticism as of common sense. But such of our readers as have made Hebrew their study know perfectly well, that in the first chapter of Genesis three words are used—*created*, *made*, and *formed*; each of these being used with the most exact discrimination, and that they are not interchanged. The word *created* always expresses the act of bringing a new thing into existence, and is applied to the three new existences of *matter*, *life*, and *spirit*. The word *made* expresses the act by which these new existences are diversified, under all the various forms of which these several classes are capable; as the various forms of matter, and various forms of life. And by the word *formed* is expressed a

still lower act than *making*, like that of a potter forming a jar of clay. In the creature Man all these operations come into act. His body was *formed* of the dust of the ground, which is not said concerning any of the animals; but as the last and most perfect form of the second act of creation—viz., animal life, he is also said to be *made*. And as being made in the image of God, and, therefore, as bringing a *new thing* into manifestation, not seen in the animals, not previously seen in any creature thing, he is also said to be *created*. And the threefold being of Man, consisting of body, soul, and spirit, is most accurately expressed in these three words, which invariably retain the same precise meaning: the body *formed* of the dust of the ground, *made* man by the impartation of life, and a spirit *created* within, as the peculiar distinction of man beyond all other living creatures.

Great and manifold are the blessings received by us through the Bible—through those Scriptures of truth which reveal to us things which we could not otherwise know, and principles which would not spontaneously occur to the mind of man; but which, being revealed, commend themselves to the conscience as true, and to the reason as consonant with all the other sound principles universally held amongst men. These blessings have regard, not only to the highest, the purely spiritual class, as God, and salvation, and eternity; nor are they limited to

things which concern our moral being, as righteousness, temperance, and judgment to come: but they bring a blessing to the understanding also. The Scriptures, in the truths which they make known, calm and settle the mind in many points which have troubled, perplexed, and bewildered the thoughts of men, wheresoever they have not had a revelation, on which faith could rest, to enlighten and guide the understanding.

Rightly to estimate the blessing which we have received, it is necessary to know what might have been our state without it; which we can best ascertain by enquiring into the state of those who have been left to their own unassisted reason, in matters which we know by revelation: if, when we find them to become fatuitous and absurd, we have but the modesty to conclude that we ourselves, under similar circumstances, should fall into similar follies. And the state of those, who are neglecting or despising a faith in the midst of which they have been educated, is not an illustration of sufficient force; they cannot but have imbibed some of the heavenly influences, some of the guiding principles, which constitute the light and life of the institutions by which they are surrounded. If we would rightly estimate what we owe to revelation, we should contrast our knowledge with that of men who have been wholly destitute of that blessing, both as it respects themselves, and

in regard to those with whom they have held any intercourse.

It is to Eusebius principally, and in his "Præparatio Evangelii," that we are indebted for having preserved to us the means of instituting such an enquiry. For it is of the nature of all advance in knowledge to extinguish the preceding rude and imperfect essays, and so to obliterate them as to leave no sufficient traces whereby we might ascertain the amount of the acquisition or the absurdity. And some of the fragments in Eusebius are so very absurd, as to excite no little surprise that they should have been preserved at all. This preservation they owe to the idea of their containing some traces, however faint and distorted, of patriarchal tradition, derived from Noah, or Melchisedec, or Shem, and carried by different tribes, with various degrees of corruption, into the land of their dispersion. And, therefore, we may be assured that these fragments were not the most absurd in existence, but such as Eusebius thought had some accordance with the truth, and such as gave some weight and colour to his argument for the wide-spread preparation for the Gospel.

We shall not enter upon the question of how far these fragments were or were not traditions of truth corrupted, or how far they were symbolic and enigmatic, inculcating profound mysteries of superstition. In any case, they answer our purpose of showing how wild men may be-

come when they give rein to imagination on subjects which we know by revelation; and of teaching us to avoid tampering with the truths that are revealed, warned against doing so by these absurdities. For if we adhere to revelation in such matters, and, taking its principles for our light and guide, endeavour thus to understand and arrange the facts we meet with, all will be rendered clear and consistent, so far as the facts extend. But if we are tempted to construct theories, where the facts are not only limited and partial, but many of them necessarily beyond our knowledge, the consequences will be palpable inconsistencies and absurdities in the theories we invent; and probably lasting injury to ourselves, in the weakening of the authority of Scripture, and its actual rejection by all such of us as are bold enough to be consistent in our tenets.

Speaking of the fragments in Eusebius, Mr. Cory says—"One of the most authentic may be found in the remains of the Phœnician history of Sanchoniatho, who is considered to be the most ancient writer of the heathen world." The fragment is as follows:—

"He (Sanchoniatho) supposes that the beginning of all things was a dark and condensed windy air, or a breeze of thick air, and a chaos turbid and black as Erebus: and that these were unbounded, and, for a long series of ages, destitute of form. But when this wind became ena-

moured of its own first principles (the chaos), and an intimate union took place, that connexion was called Pothos: and it was the beginning of the creation of all things. And it (the chaos) knew not its own production; but, from its embrace with the wind, was generated Môt, which some call Ilus (mud), but others the putrefaction of a watery mixture: and from this sprang all the seed of the creation, and the generation of the universe.

"And there were certain animals without sensation, from which intelligent animals were produced; and these were called Zophasemin, that is, overseer of the heavens: and they were formed in the shape of an egg: and from Môt shone forth the sun and the moon, the less and the greater stars.

"And when the air began to send forth light, by its fiery influences on the sea and earth, winds were produced, and clouds, and very great defluxions and torrents of the heavenly waters. And when they were thus separated, and carried out of their proper places by the heat of the sun, and all met again in the air, and were dashed against each other, thunder and lightning were the result: and at the sound of the thunder, the before-mentioned intelligent animals were aroused and startled by the noise, and moved upon the earth and in the sea, male and female. These things were found written in the Cosmogony of Taautes, and in his commentary, and

were drawn from his observations, and the natural signs which he, by his penetration, perceived and discovered, and with which he has enlightened us."—(*Eus. Præp., Ev.* i. 10. *Cory's Translation*).

How different from this is the word of revelation! In the beginning God created the heavens and the earth. God said, "Let there be light" and there was light! The heathen fictions disclose no agent—tend to no end or purpose. Revelation ascribes everything to God, as the source and origin; the omnipotent Word of God is the agent, and the manifestation of His glory is the end and purpose for which all things were made.

Those theories which emanate from the mind of man, at best, refer only to visible and sensible things—to those things which we can subject to experiment. It is to the laws imposed upon matter, to cause and effect, as observed in material things acting continuously and uniformly, that man ascribes the various phenomena he perceives; and so material and visible things are kept before the mind continually. But in Scripture, God is made all in all: He is the doer of all things. Not only has He imposed those laws, but His power and energy is present during their continuance. Nothing goes on without God: He guides and governs the laws which He has imposed, and is ready to accelerate, or retard, or suspend, or reverse the operation of

those laws, if the ulterior end and purpose may so require. In Scripture it is the invisible, it is God himself, that is ever kept before the mind; and all visible things are represented as subservient to this end.

The Scriptures declare, that in the beginning God *created* the heavens and the earth, and that, under this first act of creation, God also *made* all visible, and material, and inanimate things. Thus all the various elements were made and separated, the one from the other—the land from the water—the light from the darkness; and thus also the herbs of the field and the trees of the forest were *made*, and are not regarded as separate acts of creation, but as various organizations of those material elements which were brought into being by the one comprehensive act at the beginning—of *creating* the heavens and the earth. Yet this first act of creation contained a promise of a second act; in the fruits and flowers, designed not merely to propagate the species of plants, but to serve for the sustenance of the animal races not yet brought into being. For these, though so complicated in their organization, all belong to matter; yet they carry our thoughts forward also, as not having been designed by the Creator merely to waste their sweetness on the desert air.

The second act of *creation*, but quite distinct from the first, and as truly that which God alone could effect, was the bringing animals into being,

to occupy the material creation already provided for them. "And God *created* great whales, and every living creature that moveth, which the waters brought forth abundantly after their kind." "And God *made* the beast of the earth after his kind; and cattle after their kind; and every creeping thing that creepeth on the earth after his kind." And thus all the various fishes, birds, and beasts, are included in one act of creation—the creation of animal life. And their varieties are not spoken of as so many acts of *creation*, though wrought by God; but God *made* these varieties. And this second act, like the first, gives the promise of another—all the animals in their several instincts preparing for man.

The last act of *creation*, taking up and crowning the two preceding acts, brought man into being: as truly an act which God alone could effect; and more emphatically so, as man was created in the image of God. In this act there is a gradation, as well as a climax. God took of the dust of the ground, and from it *formed* the body of man: thus linking him with matter. God *made* man a living soul, linking him with animals; and God breathed into him of His own spirit, *creating* man in the image of God. And this must necessarily be the last act of creation; and may be said to form the visible climax of creative energy in this our sphere even of Omnipotence itself: for what creature can we

conceive more perfect than that which was made after the likeness of the Creator himself? *God-like* must needs be the last and highest of all created forms.

But it should be observed, that although, in one point of view, these three acts of creation are perfectly distinct, as much so as if they were the creations of different worlds, being of three different regions; yet, in another point of view, they are blended through insensible gradations, and linked by indissoluble ties. The material creation, in the highest forms of vegetable life, and the animal creation, in the mollusca and polypi, seem almost interchangeable: and so also animal instincts, such as in the half-reasoning elephant, approximate and almost trench upon the prerogatives of man. Moreover, this connection is shown by each succeeding act of creation springing out of the precedent acts, and embodying them so as to form one whole throughout; as when herbs and trees are brought forth from the earth; the great whales from the waters; the cattle and creeping things from the ground; and man from the dust, and from among animals, to be man. Yet, still more clearly and more forcibly is this connection and preparation discovered by tracing the connection between the form and mechanism found in different races of animals by means of comparative anatomy. Notwithstanding the infinite variety of external form in fishes, birds, and beasts, they

all afford some indications of their having reference to one common standard, which is to be found only in man. So that, beneath the apparently rude and shapeless exterior of the less perfect animals, we find a machinery of bones and muscles far more complicated than we should expect, and find the uses of this machinery developed only in the more perfect animals. Naturalists have very properly classed the whale among the mammalia, at the head of which class is man; yet what forms can have less resemblance than the lumpish monster of the deep, with its simple rudderlike action, and the ever-varying outline and agile complicated motions of the human frame? But in the fins and tail of the whale, though its simple actions need them not, the bones and muscles underneath those rude outlines are found to correspond, in number and position, with those of the hands and feet of a man. In the hoofed animals, like the horse, the external correspondence begins to appear; which increases as the foot becomes divided into toes, as in the lion and bear; and in the monkey tribe the antagonist action of the thumb, and many other correspondencies, combine to give, in external form, the rude type and promise of the man.

Creation, thus contemplated as a whole, and rising thus, stage after stage, in preparation for bringing man into being, is a noble theme for our gratitude and praise. But when it is further

added that this creation itself, in all its beauty and completeness, is only preliminary to a further purpose of God, in which man shall occupy the most conspicuous place, our sense of the dignity and importance of the creature *Man* is prodigiously increased. For *creation* was but a preparation for *incarnation;* the *first* Adam was the type, and a necessary preliminary for the *second:* the world was prepared as a stage, where, in the fulness of time, God should be manifested: the body of man was prepared as the predestined dwelling-place of the Son of God. Shall we be charged with exaggerating the dignity of man by any who believe that, at the incarnation, Godhead was united with manhood? and that the same God-man now sitteth at the right hand of the Father? or by any who believe that at the last day we also shall rise from the dead, and be like Him, and see Him as He is?

Thus it appears that the declarations of Scripture, concerning the origin of things, form one consistent whole; and that the intent thereof is not the gratification of curiosity, not even the more exact account of how these things came into being, or what is the relation they bear to each other; but that the intent is to make known the purpose of God in the creation. And the same intent is discernible in all the subsequent narratives of Scripture, whether they relate to the time when God looked down upon

the whole creation with entire approbation, and pronounced it to be very good; or whether they refer to the time when God beheld the earth to be full of wickedness, and brought a flood upon the whole world to destroy every living thing. The blessing of the earth at the first was not from mere natural causes—it was by the provision of God; the destruction of the earth for its wickedness was not by natural causes—it was a judgment of God.

In Scripture the power and goodness of God is declared, not only in bringing all things into being, but in providing for their continuance. The different forms and habits observable in the vegetable creation came not by chance, but are the work of God, and evidence design. And different plants, to suit their habits, require different elevations, soils, and climate: therefore the earth from the beginning of vegetation was diversified with hill and dale, and varieties both of moisture and of temperature. These differences in the plants had also a prospective design, diversifying the kinds of food for animals about to be created, and in creating whom various instincts were about to be implanted, leading them, according to their kinds, to choose that kind of food which had been severally prepared for each instinct. Thus, the plants being classified and aggregated by the peculiar localities they require, and the animals being classified and aggregated by the peculiar kinds of food they require, we

can perceive in this a sufficient explanation of all the facts which have been as yet brought forward in proof of such distinction between the remains of different strata, as, in the opinion of geologists, nothing short of creation and extinction can account for. And although we are quite aware of the scorn and contempt with which the natural philosophers will meet such an avowal, we do avow our belief that there were no carnivorous animals at the beginning; and that we can conceive the possibility of the wolf lying down with the lamb, and of the lion eating straw like the ox, and none to hurt or destroy upon the earth, without any change in their form or structure, without the necessity of supposing their instincts to be reversed, and merely by the subjugation of their ferocity. But there cannot be a doubt that, at the time when the strata we allude to were formed, the animals embedded therein were as ferocious as at present; and, therefore, the distinctions of carnivorous, &c., are most true and important for all purposes of natural history, and are only objectionable, when, by perversion, they are used to inculcate false theology.

And like as we avow our belief in the word of God, which has declared that at the creation, all things, including man, were very good; so on the same word we believe that the body of man, taken from the dust, to dust returns. Yet, with the whole Catholic Church, of all generations,

we steadfastly believe in the resurrection of the body; that the same identical body shall rise again, we believe, without stopping to enquire in what its identity consists. We avow our belief that man, the whole man, even the body of man, is different from other creatures; that God made this difference at the beginning, and that He will make it manifest in the end by the resurrection of the whole man, the *body*, as well as the soul and the spirit. This being our belief concerning the origin and the final destiny of man, we rather expect that it will appear, even in the physical composition of his body, that there is a provision for this difference, and shall not therefore be surprised if human remains should never be found fossilized; nor be driven thereby to the conclusion that the animal remains were deposited before the creation of man.* In those calamities also which have

* There is also one palpable argument for the presence of *animal* fossilized remains prior to the *human*, and it is somewhat curious that it has never been noticed by any writer; and this is, that the *lives of the Patriarchs*, being of vast extent, embrace few *human* deaths over a large period of *animal* extinction. Adam died in the nine hundred and thirtieth year of his age: consequently, supposing the present fossilized remains of animals to be ante-diluvian, their types would far outnumber the human in those early periods when races of men were not exterminated rapidly lest the exuberant animal life should overpower the human. Of this exuberance but a small portion is now visible in a fossilized form; the absence, therefore, of *human* remains was most naturally to be expected, and the presence of animals in the fossilized varieties.

overtaken multitudes of the human race, within the time to which historical records ascend, how little remains of man! and especially where water has been the destroying agent. The ashes that destroyed Herculaneum and Pompeii have a few remains, though very few compared with the population of those cities; but in other catastrophes, as that in which sixty thousand persons perished at Lisbon, in 1755, we cannot expect that a vestige will ever appear. On one spot, where a great concourse of people had collected for safety, the quay, on thich they stood, sank to the depth of one hundred fathoms, and not one of the dead bodies ever appeared. And in the late blowing up of the *Royal George* how little was the record of the hundreds of souls that had been there engulphed!

The deluge, which is spoken of in Scripture as the *only* universal catastrophe, was, in all its circumstances, unprecedented, and stands yet *alone*, as never having been repeated. All catastrophes may, in one sense, be ascribed to God, but not in the same sense as the deluge of Noah; whether we regard the deluge itself, or the causes and consequences: and we greatly mistake the meaning of Scripture if we suppose *that* deluge to be in any respect like an inundation produced by rain, or the other agencies which are now in operation. We know, in fact, that an *universal* deluge, from *natural* causes alone, is an impossibility now; there is not water to effect

it, and only folly will expect such a catastrophe, by any agency existing in nature.

The deluge of Noah was, in all respects, *supernatural;* it was by the immediate hand of God himself. God threatened it beforehand, for the sin of mankind. He commanded Noah to proclaim it beforehand, while preparing for his own safety; and He announced to Noah the precise time; and the safety of Noah being assured, God opened the windows of heaven and the fountains of the great deep. We are too apt to evade the true meaning of such passages as this, by supposing the language to be metaphorical, or, in plain words, so exaggerated as to be untrue. Words that record an unprecedented thing must, in a sense, be metaphorical, because you have no fact exactly like it; but yet the new fact is itself literally and exactly true. The deluge came in the form of rain from above, and of floods from the deep beneath; but no ordinary rain, no ordinary floods, could bring on *such* a deluge, and therefore the windows of heaven are opened, and the fountains of the great deep are said to be broken up.

From its being declared, at an earlier period (Gen. ii. 5), that there was then no rain, but that a mist watered the earth, and from the rainbow being first introduced *after the flood*, and in a new constitution of things—it is generally supposed that the whole constitution of the atmosphere, so far as clouds, rain, &c., are con-

cerned, underwent a change at the deluge. But we do not need a discussion of this at present, having principally to notice the breaking up of the fountains of the great deep, as being the main cause of the deluge, and of which, therefore, we ought to find traces still remaining upon the whole surface of the earth.

Since the time of Newton, the laws of matter and motion have been better understood than formerly; and the late advances in chemistry, and in the experimental branches of science, have shown that matter is never either created or annihilated by us, but only assumes a different form, or enters into new combinations, when it seems to be destroyed. By the laws above-mentioned the earth is kept in its orbit, and any change in the bulk or density of the earth, *as a whole*, would alter its motion and change its orbit. And so also, in the constitution of the earth itself, there is a balance observable in the elements, so that the quantity of its solid, liquid, and gaseous constituents remains the same at all times; and if there be an increase of any one element *in one place*, there is a correspondent diminution of that element *in some other place*. Hence every *elevation* of the land will produce an equal *fall* of the water; which would appear to be *double* its actual amount, as there would be a movement of both in *opposite* directions, if measured from any fixed point. This it is scarcely possible to measure, from the

small amount of the greatest elevations compared with the bulk of the water of the ocean; and still more from any fall of the ocean being, of necessity, *not local*, but diffused over its *whole surface:* so that the rise of the whole of Great Britain could scarcely cause a fall in the ocean of more than a hair's breadth. In proportion as this is considered, by so much the more will the impossibility appear of an universal deluge being produced by the *rising of the water*, or by any known natural causes, or any laws *at present in operation:* nothing short of the *subsidence of all the land*, and that to a degree *equal to half its bulk*, could bring about an universal deluge. And this is what we understand in the breaking up of the fountains of the great deep—the chief thing spoken of in the deluge.

The fountains of the great deep are often regarded merely as the fathomless ocean, and breaking up as only the heaving or lifting these volumes of water. But water cannot raise itself —some solid substance must displace the bulk of water to be raised; the earth must be depressed, that the fountains of the deep may overflow the earth. And what agency can accomplish this, but the power of God! The fountains of the deep, however, lead our thoughts to the bowels of the earth, from whence they spring, and require us to consider in what way the depression of the earth for the deluge, and its subsequent restoration to its present state, would

be a breaking up of the bowels of the earth, and what kind of traces it would leave: for we are always assuming that God has a purpose in all He brings about, and uses for accomplishing it those very instruments which He has already provided as best fitted for the work.

We know, from numerous instances of eruptions consisting only of mud, that there are liquid reservoirs of this kind in the bowels of the earth; and these may be of very vast extent without our knowing it, as they remain quiescent when undisturbed, and only appear when burst in upon by some volcano. And to the *ejected* mud, rendered impure by the volcanic vapours, we are now alluding; not to the muddy streams occasioned by the rains which often accompany eruptions of volcanoes. Could we penetrate deeper, we should probably find, beneath the stony crust of the earth, all the mineral substances in a state of chemical solution; and whatever be the thickness of the stony crust, and however much we may hesitate in allowing any speculations concerning what may lie beneath, all must at least allow that the *thinnest* part of that crust is at the bottom of the sea; and if that which lies beneath the crust should break out anywhere, it would break out *there*, where the fountains of the great deep are seated; and such an ejection into the bottom of the ocean would be a sufficient machinery for depressing the land and raising the water for an universal

deluge; and a subsequent re-absorption into the same deep chambers, by the raising of the land, would be a sufficient machinery for removing the waters of the deluge. Many instances occur of petrific materials thus bursting forth; and such outbursts will, we believe, be found invariably at the upper end of every extensive valley of denudation. These outbreaks of the lower strata are accompanied with a lifting and bending of the superincumbent masses, showing that they were then in a soft or bending state; and none of these rocks bear the least traces of heat —nothing like lava or basalt is found. And the under or outbursting rocks are often lifted to a much greater height now than any present remains of those strata which they have displaced.

And here, with the classification of animals and plants, which we have laid down as a thing of course at creation—and with the fountains of the great deep breaking up, and thus imbedding in classes those animals which they found in their way, as surge after surge broke forth, at different depths—we might construct a very pretty geological theory, if so disposed to do. And we say, most seriously and advisedly, that we could, on such an hypothesis, explain the geological facts more consistently and more intelligibly than the geologists do by the hypothesis now in vogue. But we will not do any such thing—we will wait for more facts—we will

counsel our readers to wait, and, in the mean time, content ourselves with denying that any of the facts militate against the narrative of Scripture, or that Scripture may be in such a fashion qualified, as is recommended by those who maintain the geological theory, and yet believe the Bible.

The fate of Galileo, and the retribution of more enlightened times, is a standing topic for self-applause with the geologists. But there was on Galileo's side the consistency and coherency which accompanies truth, and, to some extent, that demonstration which has since been brought out of the whole extent; and he was opposed, not by argument, not by any endeavour to show the fallacy of his statements, but with overbearing authority alone. The geological theory, on the contrary, is inconsistent with the facts, incoherent in its parts, contrary to known principles of science, and it is opposed on these argumentative grounds, and not by the mere dictum of authority—all the dogmatism is with the geologists. A comparison with astronomy is that which is most unfavourable to geology; and the setting their theory beside that of Galileo is the thing which the geologists ought most to deprecate. The cycles, epicycles, and vortices, which the Newtonian system supplanted, would agree much better with their millions of acts of creation and extinction, through which this world is supposed to have floundered on. And the

glorious science of astronomy is not less elevating to the mind by its harmony, simplicity, and sufficiency, than it is exalting to the spirit, by keeping God continually in view; the understanding perceives the laws to be godlike, and the spirit is lifted up to God himself.

And until the same is the case in geology, we shall not believe that the geologists have discovered the true theory. What! when of astronomy this very earth forms a part? When, as one of the heavenly orbs, the earth obeys those laws of motion so godlike in their simplicity, certainty, and permanency!—shall we be expected to believe that the earth itself has been nothing better than the sport of chance—its primal law a chaos—and the remedial laws earthquakes and volcanoes? Let us have a law for the constitution of the earth which will bear some tolerable comparison with those laws, which, after it was constituted, all acknowledge that it has obeyed.

God has not two ways of acting: one, orderly and balanced, in the motions of the heavenly bodies; another, the opposite, and nothing but disorder, in the fabrication of the earth. And it is not pretended, even by geologists, that God is thus inconsistent. But when they allude to God at all, it is only as having provided the crude materials, and having endowed these with certain powers of attraction, repulsion, &c., and then left them to themselves to work out a

world as best they might; with time enough before them of countless millions of ages; with no need to care for any waste of life, if they could get it, nor for any individual pain and suffering; as it might come to be discovered that the "aggregate of animal enjoyment is increased" in the individuals being devoured by one another, each having the pleasure of devouring many before he is himself devoured.

Nor does God teach two opposite lessons, saying one thing in his word, and doing another thing exactly the contrary in his providence. One of the earliest discourses of Christ was designed to impress upon his disciples the necessity of discerning God in all things, that they might trust him at all times and in all circumstances. He taught them that the very hairs of their head were all numbered, that the sparrows fell not to the ground without God, and that he clothed the grass of the field; much more would he care for them, and all belonging to them. We are told to consider the lilies, and to mark their beauty, in order to infer, not merely the wisdom and power, but also the love and care of God; that his goodness is perfect as his wisdom, and his providence unwearied as his power. It was not by accident that the fields were clothed with verdure: and the same Providence brought the world itself into being, and continually sustains and governs it, with such care as we may infer from all we behold around us, and in such

regularity as we find in the returns of summer and winter—of day and night.

And this in order that we may refer everything to God, and trust to him at all times. Not trust to an abstraction—a great first cause —or some unknown god; but to one whom we can know, and know most accurately, both because we are made in his image, and because he hath revealed himself to us; most accurately, though not fully, for we are finite, he is infinite; yet truly, so far as our limited capacity, and the revelation which he has given, extend. Such a reference of everything to God will not cramp investigation in the least; nor has natural philosophy any necessary and inevitable tendency to turn us aside from God. On the contrary, the contemplation of the dependence of each thing upon some other thing, and of all things upon principles and laws, which become more simple and more universal in proportion as they are better understood, should necessarily lead, and will inevitably conduct the rightly informed, to the one grand unity which is only to be found in God—to that into which every law must be ultimately resolved.

This is the end and purpose which we have kept in view during these remarks. We have endeavoured to show that there is a wide difference between the *explanation* of a fact, and the investigation of the *laws and principles* which that fact may be thought to involve. The facts

of the geologists we do not question; and most of the explanations of those facts we have little scruple in admitting; but when they attempt to draw inferences, and lay down principles, inconsistency and failure stare us in the face on every side. And we know not which to wonder at the most, either their blindness to the inconsistency, or their blinking of the failure; their contradictory inferences neutralize each other, and their principles are obliged to be bolstered up at every step, by creation after extinction.

The laws of God, and the principles which he has revealed, are uniform as his own being, and stable as the throne of heaven. Their courses are orderly and progressive, and any seeming irregularity is either but local and temporary and accidental, or, like an eclipse of the sun, does but more clearly mark the certainty of the order. By the progress of astronomy we look with calmness and intelligence upon those phenomena, which once filled mankind with terror so great that contending armies threw down their weapons. And even the blazing comet, which, "from his horrid hair shakes pestilence and war," and "frights the nations," *in poetry*, is now beheld in its eccentric orbit, of so many centuries, but as forming part of the same system, and governed by the same laws, as the earth itself in its annual and diurnal motions—one law governing such widely different appearances.

These comprehensive principles in astronomy, which embrace all the phenomena, and account for all the appearances, were the result of a diligent collection of facts, and the reward of persevering investigation; and they have dispelled the mists of the old astronomy, and brought order out of that chaos. And so in geology, by pursuing the same course, we may expect the same results. That such results have been as yet attained, the geologists themselves will not affect to maintain. But we believe that principles may be discovered, embracing, explaining, reconciling, all the phenomena concerning the constitution and arrangement of the materials of the earth, as universal as those which regulate its motions in its orbit. Then will the erroneous systems of geology be exploded, like the forgotten systems of astronomy, and then will the deductions of science be found, in this instance also, to explain and confirm the declarations of the Bible.

## CHAPTER II.

1. M. Agassiz' Etudes sur les Glaciers.—2. Maclaren's Analysis.—3. The Glacial Theory.

The great progress which all acknowledge we have made in the science of geology is to be attributed entirely to the more numerous and more accurate observations now within our reach; from the far more extensive excavations going on now than at any former period; and from the superior intelligence of those employed in superintending, if not in executing, these works. And not only in the number, but in the quality of the observations do we possess advantages beyond those of our predecessors, since the time that geologists have become convinced of the value of characteristic and pregnant facts—facts which prove a point, and contain matter for inferring other consequences—facts like those which have led to a determination of the separation and sequence of the different strata of which the earth's surface is composed. In collecting such facts the Geological Society of London may be regarded as occupying, if not the foremost, at least a very

distinguished place; and may still, as in one of its earliest reports it did, refer to its transactions as "a proof that the society has not existed merely as a name, but has successfully directed its efforts to the promotion of rational geology, *as a science of observation.*"

In a recent account of the modern progress of geology it is written:—"A great body of new data was required; and the Geological Society of London, founded in 1807, conduced greatly to the attainment of this desirable end. To multiply and record observations, and patiently to await the result at some future period, was the object proposed by them; and it was their favourite maxim that the time was not yet come for a general system of geology, but that all must be content for many years to be exclusively engaged in furnishing materials for future generalizations. By acting up to these principles with consistency they in a few years disarmed all prejudice, and rescued the science from the imputation of being a dangerous, or at best but a visionary pursuit."—(*Lyell*, vol. i., p. 106.)

This was quite true—for a while they had disarmed prejudice by this prudent course; but it is no longer true—prejudice has revived; and wherefore? Simply, because geologists have abandoned this safe path, and returned to their old course of theorizing. "Speculative views were" then "discountenanced," but not so now; and men more than hint that excessive caution,

rather than wisdom, prescribed their former line of conduct, and that this caution is no longer necessary, when they say—"But although the reluctance to theorize was carried somewhat to excess, no measure could be more salutary at such a moment than a suspension of all attempts to form what were termed 'theories of the earth.'" (p. 105.)

There are still remaining many of the old members of the Geological Society who hold to their first principles, and we entreat them to be now steadfast in discountenancing the random "speculative views" which are again become prevalent, for they may be assured that this rage for theory is exciting prejudices which it may not be easy to disarm.

The mischief resulting from "speculative views" is not merely diverting men's minds from the far more important work of observation, but the further mischief ensues, that when they engage in collecting facts, their minds are poisoned and vitiated by theory, and their observations are so one-sided, so distorted, so visionary, and they cannot be received with confidence, and cannot stand for a moment in opposition to the observations of those who are disabused of these "speculative views." A ludicrous instance occurred a few months ago at the Geological Society, where two members, who are both rather inclined to theorize, had their enthusiasm so much excited by "the glacial

theory," that they separately resolved to start forthwith to discover proofs of glacial agency among the mountains of Wales. The least sanguine of the two returned first, declaring that he had sought in vain on the declivities of Snowden and Moel Siabod for marks of abrasion and grooving of surface, such as he had been led to expect. The other returned a few days later, having found, as he thought, *satis superque*, most abundant proofs of the truth of the theory in the grooving of almost every mountain slope he examined. His disappointed brother eagerly enquired for the localities of these unequivocal demonstrations of the theory, in order that he might post off again to obtain that satisfaction which he had missed on his former journey, and he found to his surprise that most of the localities were places which he had recently visited! He expressed additional mortification at his not having been able to discover these interesting marks, in that the weather had been remarkably bright and favourable for observation; but herein he was corrected by his brother, and the different results of their journeys at once explained, by the *discoverer* telling him that he had visited the district in *rainy weather*, and that the rocks *being wetted* he had detected marks upon them, which might have escaped even his research if they *had been dry!!* And hence we learn the interesting fact in modern geology, that observations are better made in a shower of rain by

one person than in the brightest sunshine by another.

Touching "the glacial theory" itself, it is such as is calculated to convey important information, and also to furnish seasonable warning; therefore we think it right to bring it under the notice of our readers. Few of them will need to be informed, that M. Agassiz, from whom "the glacial theory" has derived all its celebrity, is a most deservedly eminent man, who has done as much towards perfecting our knowledge of the finny tribes as M. Cuvier had done towards our knowledge of quadrupeds. And the labours of M. Agassiz have a still more extensive bearing upon geology than even those of M. Cuvier, however important in themselves these last may be; since the strata in which fish are contained, and of which they are characteristic, are far more numerous than those in which land animals are imbedded, and we knew less of fishes than of animals; and the fossil fish most widely diverge from any living types at this time to be met with in the ocean. From the talent displayed by M. Agassiz in ichthyology we would not detract an iota.

And in the examination of the glaciers of his native mountains, there is every reason for believing that the same kind of sagacity and accuracy have been employed, and that he has rightly apprehended and truly described those phenomena concerning glaciers which came

under his observation. And in the inferences which have been drawn from the observations of M. Agassiz, we can coincide, so far as to allow it to be probable that wherever there are glaciers agreeing with those of Switzerland, in the three conditions of elevation, slope of land, and climate, the phenomena remarked by M. Agassiz will be produced by those glaciers. But it is too large a draft upon our credulity "to try conclusions" the other way, and to expect us to believe, that wherever there are such marks on other rocks a glacier has produced these appearances; and that because a glacier has been there, the elevation, slope, climate, and every thing else, have also been there as a matter of course, though it may have been some ten or twenty millions of years before the creation of man! To such conclusions as these "the glacial theory" requires us to assent, and we pause to examine the grounds on which such assent is demanded, and find those grounds altogether insufficient.

The marks upon rocks which are adduced by the advocates of "the glacial theory," in proof of the former existence of glaciers in those localities, are marks similar to those which have been observed upon rocks lying *in the track* of the glaciers of *Switzerland*—in the track of these particular glaciers; for glaciers may exist without any of the local circumstances which in this instance combine to produce the periodical move-

ments in the ice, and leave these traces of their course upon the rocks. In this, and we may also grant in every similar locality, "the glaciers which fill the Alpine valleys have in summer a slow downward motion, which is partly due to gravitation, and partly to the dilatation of the mass during the freezing of water infiltered into pores and rents.....The boulders, gravel, and sand, which lie underneath the glacier, and are pushed along by it, sometimes adhere to the ice, and as the mass glides slowly along at the rate of a few inches, or at the utmost two or three feet per day, they abrade, groove, and polish the rock, and the larger blocks are reciprocally grooved and polished by the rock on their lower sides. As the forces, both of pressure and propulsion, are enormous, the sand, acting like emery, polishes the surface; the pebbles, like coarse gravers, scratch and furrow it; and the large stones scoop out grooves in it. Although the surface of almost every kind of rock, when exposed in the open air, wastes away by decomposition, yet some retain for ages their polished and furrowed exterior; and if they are well protected by a covering of clay or turf, these marks of abrasion seem capable of enduring for ever. They have been traced in the Alps to great heights above the present glaciers, and to great horizontal distances beyond them."—(*Lyell's Elements*, vol. i., pp. 243, 247.)

In order to produce these effects, or leave

these marks upon the rocks, it is evident that three conditions are required—similar elevation, as great a slope, and as warm a climate; for it is by the combination of these that the effects above enumerated are produced. To obtain sufficient cold in winter to freeze the glacier, sufficient warmth in summer to propel it, and sufficient slope for the action of gravitation, such an elevation as the Alps, and such a climate as Switzerland, must combine. But will the advocates of this theory go the length of maintaining that Snowdon formerly had the same elevation as the Alps, and that Wales formerly had the same climate as Switzerland? And if they are thus bold, how is this to be held in consistency with its present state; and with the supposed continuance of those abraded rocks, undisturbed on the surface of the earth, ever since the time that the glacier passed over them, when changes have indisputably taken place which render the existence of glaciers in that region manifestly impossible? And, above all, how is such an hypothesis as this consistent with the fundamental principles which they all start from —of accounting for all things according to laws now in operation? For this would require Snowdon to be lifted, we know not how, to thrice its present elevation! And would require the poles of the earth to be shifted till the latitude of Wales agreed with that of Switzerland! And all this on the false assumption that glaciers

alone, and not any other force, can thus abrade the rocks; and that natural structure has never been mistaken for marks of such abrasion!

The evil, in all theories, against which we have most need of guarding, is that of so exaggerating particular facts, and so straining local circumstances, that they first overbear, and then take the place of general laws, and even universal principles. In our geological observations, we should ever bear in mind that we cannot rightly understand local appearances by regarding them merely as local and insulated phenomena. The laws which operate in one place are in harmony with the laws which operate, at the same time, in al other places: strata belong to those masses which form mountain ranges; these last to continents; continents to the world; and the world is subject to those laws which astronomy has revealed as governing all matter within the bounds of the solar system. We may not, in order to help out an hypothesis, lift mountains, and sink continents, and change climates at pleasure: these are under fixed laws—generally laws of order; and, where disorder seems to come in, it will be found that there is compensation elsewhere, and that this equipoise preserves order, on the large scale, and virtually, even in those instances in which it appeared at first sight to be violated.

Wherever men have observed facts difficult of explanation—such as the transported blocks

of the Jura, the greyweathers of the chalk downs, and the boulders of various countries—they have been tempted to solve the difficulty by having recourse to icebergs, or continuous glaciers, or mighty streams like the St. Lawrence, without duly regarding the great general laws, alluded to above, which are violated by such explanations. M. Agassiz himself certainly violates these laws in imagining that the whole valley of Switzerland was once filled with ice, and that one great sheet of it extended from the Alps to the Jura—an hypothesis which cannot be maintained, without also maintaining that the poles of the earth have been shifted, for which there is no shadow of warrant. And which also labours under the additional and experimental objection of giving only "an inclination of two degrees, or far less than that of any known glacier."—(*Lyell*, p. 250.)

And if Mr. Lyell had kept these universal principles steadily in view, he would not have felt the temptation which he expresses in the following words—words which remind us of some of the wildest speculations of the cosmogonists, whom he, in the early portions of his work, condemns with just severity:—

"If it be asked where the continent was placed from the ruins of which the Wealden strata were derived, and by the drainage of which a great river was fed, we are half tempted to speculate on the former existence of the Atlantis of

Plato. The story of the submergence of an ancient continent, however fabulous in history, may be true as a geological event. Its disappearance may have been gradual; and we need not suppose that the rate of subsidence was hastened at the period when the displacement of a great body of fresh water, by the cretaceous sea, took place. Suppose the mean height of the land drained by the river of the Wealden estuary to have been no more than eight hundred or one thousand feet; in that case, all except the tops of the mountains would be covered as soon as the fundamental oolite and the dirt bed were sunk down about one thousand feet below the level which they occupied when the forest before mentioned was growing."—(*Elements*, vol. i., p. 432.)

This is a sample of the random speculation, looseness of connection, and disregard of general principles, which so much pervade modern geology. A large continent is lifted one thousand feet above, or sunk one thousand feet below, the surface of the ocean, as if it were a piece of chalk in a basin of water. It is not remembered that the land and the water are so adjusted and proportioned, that the surface of the earth, considered as a whole, remains the same—the same relative proportion of land and water: so that the gain of either, in any one place, is compensated by an equal loss in some other place, and the same proportion is preserved.

Mr. Lyell grants all the physical principles that we require, in another part of his writings, when, in reasoning on the vicissitudes in climate, he assumes, "First—That the proportion of dry land to sea continues always the same. Secondly—That the volume of the land rising above the level of the sea is a constant quantity; and not only that its mean, but that its extreme height, are liable only to trifling variations. Thirdly—That both the mean and extreme depth of the sea are invariable."—(*Principles*, i., 176.)

But, above all, it is ever present to our minds, that the distinction between land and water, both in its commencement and in its continuance, is *contrary* to the properties of matter and the laws of nature. The distinction consists virtually in raising the heavier substance, which is the land, above the lighter substance, which is the water; and against this *unnatural* elevation of the earth, as it may be called, the levelling powers of *nature* are continually at work; the waters beneath undermining, and the waters above decomposing and dissolving, and the earth, by its downward tendencies, according to the laws of gravitation, seeking its *natural* place at the bottom of the waters. It was no power of nature that first separated the land from the water—it was God himself. He raised the land into mountains and hills, and scooped out the hollows for the deep. "God said, Let the waters under the heaven be gathered together unto one

place, and let the dry land appear." And as it was God that made the distinction, he made it in that measure and proportion which best agreed with what he next intended to do. The land was separated that it might be inhabited; and for the sustenance and well-being of its inhabitants, it was covered with vegetation and surrounded with a salubrious atmosphere; neither of which blessings could be maintained and perpetuated without a constant and a regulated supply of water. And this supply ultimately resolves itself into such an adjustment of the proportion of land to water over the whole surface of the earth, that the processes of evaporation and condensation may go on to the same extent at all times.

And the earth still needs, and its inhabitants still require, the continuance of the same provisions for their well-being, which God in the beginning made. And there is no power in nature itself to continue that just proportion between land and water, from whence they all result, as there was no power in nature to commence it. So that now, as at the beginning, and throughout all intermediate time, we are thrown upon the providence of God, from whom, not by a figure, but thus literally, we derive "life, and breath, and all things." The Christian believes this on the word of our Lord, who hath declared that our heavenly Father clothes the grass of the field, and feeds the fowls of the

air, and numbers the hairs of our head; and the mere naturalist, if any such there be, is driven to the same conclusion, by the insufficiency of the powers of nature to accomplish this. He also must have recourse to *supernatural* power; he also must attribute it to the providence of God.

In the reckless prosecution of theory, against which we are endeavouring to warn our readers, as in so many other cases, extremes are found to meet. While one party is pressing cold into its service in "the glacial theory," another party is endeavouring to account for all things by the theory of central heat: and, like the advocates of the glacial theory, these last look at facts with a predetermination to find in them something like a confirmation of their theory.

Papers were read before the British Institution, both at Plymouth and at Manchester, the purport of them being to resolve the formation of all rocks, and especially those of Devonshire and Cornwall, into the agency of central heat. But as these papers rather assumed the agency of heat, than stated the grounds on which the theory rested, we take in preferance the statements of Cordier, before the French Institute, and the experiments of Fox in the mines of Cornwall.

The theory of central heat is not new. It was maintained with some *éclat* by Burnet in his day, and by Hutton and Playfair, as the

antagonists of Werner, some forty years ago. But all these rather assumed the theory, as explanatory of acknowledged phenomena, than attempted to prove it by direct experiments upon the heat of the earth, and upon its progressive increase downwards, or towards the centre. The mere idea of experiments to determine central heat, to ascertain its existence and amount by digging, is somewhat ludicrous to a sober man, who remembers that our deepest excavations, compared with the bulk of the earth, are no more than feeble scratches upon the surface, and do not represent a greater thickness than the finest line we can draw to determine the circumference of a circle. Yet, as such experiments have been made, and arguments are founded upon them, we will state what they are.

It has been observed, as a general rule in mines, that the deepest of them are the warmest, and that the heat of the rocks themselves, and not merely that of the air, increases in proportion as we descend. The increase is common to all mines; but the rate of increase is not the same in different countries, nor yet in different mines of the same country, though nearly uniform in the same kind of mine. In the deep coal mines of Durham and Newcastle the increase is estimated at one degree for forty-four feet of perpendicular descent. In the still deeper mines of Cornwall, seventy-five feet of descent is the estimate for each degree of heat. At Grenelle, in a well

nearly as deep as the Cornish mines, it is sixty feet to a degree; and in Saxony, though the lead and silver mines indicated one degree of increase for every sixty-five feet, in other mines of the same country the increase was only one degree in 180 or 190 feet.

Cordier states the mean result of all the best observations as one degree of heat for forty-five feet of depth, and he assumes that the heat increases in the same ratio downwards, to the centre of the earth. Hence it would follow, that at two miles below the surface the heat would equal that of boiling water; at about twenty-four miles depth it would be hot enough to melt iron, and below that such a heat as we cannot estimate, and, for our own parts, cannot conceive. This we assert to be all pure assumption from the beginning to the end; the theory is not a legitimate inference from the observations; and such a volume of heat within the bowels of the earth cannot be assumed without contradicting all received principles concerning heat.

What is the *maximum* of increase which the observations show? Barely twenty degrees in the deepest of the mines—only a temperature below that of our summer months, and but eighteen degrees above the mean temperature of both summer and winter in Cornwall. The observations in the Dolcoth mine, at a depth of 1380 feet, gave a mean temperature of sixty-eight degrees, that of the surface being fifty

degrees. At such depths as these, the vicissitude of seasons, and the difference between summer and winter, are altogether annihilated; and a temperature of sixty-eight is not too high for that of the earth itself, when not subjected to those vicissitudes. The temperature of the Gulph stream is as high as eighty-six; and Scoresby asserts that its effects upon the ocean are perceived as far north as Spitzbergen, where it undermines the icebergs, which are exposed to its action, in a very marked manner, when compared with those out of its reach.

And then to infer from this very moderate temperature such an increase, *ad infinitum*, as it were, is almost too absurd to reason upon. If the heat acquired that degree of intensity which would melt iron, it could not get beyond that at any depth; for when solid substances become fluid the heat is then *equally* distributed throughout *the mass;* and, before a *crust* can form on the *surface* of such a fluid, *the whole mass* must be cooled down *to the point of consolidation*, just as before a film of ice can form on water, that water must be cooled down to the freezing point. So that the consolidation of the crust of the earth does really prove that there is no liquid mass, no central fire, within.

As for volcanoes, hot springs, &c., these have nothing to do with the question of central heat, for they are local and superficial when compared with the bulk of the earth; and all such

temporary or variable eruptions are obviously referable to chemical decomposition and galvanic agency, and fermentation among the several oxides and alkalies, when they have accumulated in sufficient quantity.

If we probe and analyse the frame of mind which originates such theories as these, or even loves to entertain and brood over them when invented by others, we shall find at the root of it a certain morbid and moody habit of abstraction, which shuts out actual existences, and delights in placing itself on the outskirts of creation, beyond the region of things truly knowable, and thence gazing with vacant wonderment into the unknown infinitude beyond; in which, seeming possibilities, and the misty phantoms which imagination conjures up, are mistaken for sublime realities. Such a morbid turn of mind was that of Jacob Behmen, and of most of the alchemists, who can scarcely be charged with the crime of seeking to dupe others, for they had duped themselves into the belief of those things which they had so long cherished in their imagination.

And such a turn of mind is found in some persons in all ages, varying its form and its intensity according to the pursuits of the age, but substantially the same now as in the darker ages, though professing to be the product of light and science. To render ourselves intelligible, we extract a passage from the writings of one in

whom this turn of mind strongly appears, and who is also an enthusiastic votary of science; but, as we are sure that he is unconscious of his state, we will not inflict the pain of publishing his name:—

"Methought I glided adown the stream of time into the oblivious profound, where flit the unreal shadows of extinguished generations. And amid the horrible darkness I beheld monstrous and dire skeletons, that came from nature's untutored hand ere the divinity called order from chaos forth. And shapes big as leviathan, and more terrible; and ghosts of unfinished existences.....gaunt—unutterable were they..... Over these vestiges.....over the wide jaws that first committed murder in obedience to the stern laws of necessity, we love to dwell. Such countless hosts of associations are connected with these gone-by things—so much of the sublime and the mystic, of the eternal and inspiring, that we invoke fate to continue them ours for ever; they are sensations—operations, that concentrate infinity and identify it—a something that the human understanding can grasp bodily, and be satisfied therewith, like the opium-eater and his drug, for awhile."

Such is the intoxication we are speaking of: not often seen in this excess, but to a certain degree infecting the spirit of all the victims of theory.

The spirit which we would endeavour to cul-

tivate and recommend is the contrary of this: we would study the things that are known, instead of expatiating in the unknown. We would look at nature as coming forth from God, and leading back continually to God. We would derive our knowledge of God from what he has revealed, and we would make this knowledge of him the key to unlock, and the interpretation to explain, the mysteries of nature. We would make his attributes of love and mercy, as well as of power, the principles to be held fast in examining the works of creation. And all, in order that his word and his works may not contradict each other; that we may not at one time love him as a father, when reading his word; and at another time dread him as an unknown fate, when beholding the works of his hands; but in a hale, vigorous, cheerful frame of mind, believe in the beneficence of God, and behold in Nature a continual display of that beneficence.

The origin of evil is quite another question, and brings into display another class of attributes in God, both as regards his tolerating it at all, and as regards the remedy he has provided. But we mention it now, only in order to pass it by, as it does not belong to this present question. The knowledge of God himself must of necessity go before, and prepare for our rightly understanding his works. His character is the standard which enables us to judge aright of nature; and

the Scripture narrative of creation evidently presupposes that those into whose hands the history would come *did already know God.* Moses begins the history abruptly, and without any preparation or preface, because it was written for a people to whose forefathers, Abraham, Isaac, and Jacob, God had made himself known centuries before. Nay, from the beginning, through Adam, and Enoch, and Noah, God was known; and wherever the tradition of *creation* could come, the traditionary knowledge of God would come with it. And looking at the Mosaic history, we find that the leading idea and fundamental principle throughout the whole narrative is to bring forward God as the origin, cause, and accomplisher of all things—the beginning and the end, the all in all. Thus, in the beginning God created the heavens and the earth, and, after the completion of this work, set apart one day in seven for ever as a perpetual memorial thereof, and also as the means for retaining perpetually the blessing which he had pronounced over the complete creation.

And the leading idea which we, in looking at nature, should endeavour to retain, and desire to see embodied in all the phenomena we examine, is the same—that all visible things are records of what God has wrought; that they witness not of themselves, but of another; that the form they bear is not chosen, or wrought out, by themselves, but that God gave the form—that he imposed the

laws, and set them in their several places at his own will, and to fulfil certain purposes which he willed to accomplish.

The Scripture narrative, in declaring that God created all things, presumes that those, into whose hands the record shall come, know who God is, and what his attributes are; and in every subsequent page his wisdom, goodness, and truth, are inculcated as continually as his almighty power; so that moral instruction is given at the very time when the understanding is informed concerning matters of fact. And in the record of the acts of God we are taught to love and fear, to acknowledge and worship him, who hath made these things for an end, even for this very end—of teaching us his ways and revealing to us his various attributes.

But the phenomena around us, and especially those with which geology is conversant, do not and cannot presume on our knowledge of God, and contain no means within themselves, such as the Scriptures do, of inculcating that knowledge at a subsequent stage. On the contrary, the pages of geology record havoc and destruction alone, without recording the causes for so much appearance of suffering. We behold countless generations of beings, in which we cannot but admire a most wonderful variety, of beauteous adaptation of form and instinct in each individual, to its own sphere of existence; yet, as a whole—as a creation, the sum-total is misery—

wholesale, unmitigated carnage—fitly consummated as well as terminated in one universal hubbub of the elements, in which fire, air, earth, and water, in the most malignant combinations that can be conceived, have spouted forth torrents of lava, engulphed whole continents, dashed the ocean over mountain tops—and all to bury and hide from the sight of heaven, creatures demon-like in mutual hate and the mutual torments they inflicted; and among whom the only possible safety for any one creature lay in sharpening to the uttermost, and keeping in continual activity, all such instruments in its frame as could possibly be turned to mischief.

Thus geological phenomena, taken by themselves, and apart from the knowledge of God which we have derived through other channels, would teach us a false lesson; and we might be led to infer that the world and its former tenants had been, at best, but the sport of chance, and had turned up an unlucky existence; or, still more probably, should be driven to the atheistical conclusion, that some demon had brought the creation into being, and swept it into destruction after becoming satiated with a sufficiently long contemplation of its varied evils. Therefore we require a knowledge of God, derived from other sources, to prevent these false inferences; and we need a knowledge of the history of the world, beyond that which the study of its component parts can teach, to ac-

count for its wrecked and ruined appearances: and this the more especially, because in those very wrecks we can yet perceive how goodly a fabric this very ruin had formerly been, and how many provisions for happiness have been perverted, so as to end in misery.

Both Bacon and Newton—justly regarded as the men who have done most, among moderns, for the placing of science on its true foundation—strongly insist on the necessity of making a knowledge of God the preliminary and the first step, even to science in the abstract, or universal science; much more, therefore, in any one branch of science, such as geology. Bacon says—"Let us first seek for the dignity of science in its archetype or exemplar—that is, in the attributes and acts of God, so far as they are revealed to man, and may be discreetly investigated by him. In which enquiry we are not to speak of doctrine, since all doctrine is acquired knowledge; yet no knowledge in God is acquired, but original. We must, therefore, seek another name—that of *wisdom*, by which name the sacred Scriptures denominate it."

Bacon is here referring especially to the wisdom of Proverbs (viii. 22, 23), to which we recommend our readers to turn, that they may perceive the full force of the reasoning of Bacon. He afterwards goes on to show the distinction between acts of power and acts of wisdom; and exemplifies the distinction in the creation, as recorded in the first chapter of Genesis:—

"Thus, then, the fact stands. In the works of creation we behold a *twofold* emanation of the divine virtue; of which, the one relates to its *power*, and the other to its *wisdom*. The former is especially observed in the creating the material mass; the latter, in the disposing the beauty of its form.....We may further observe, that, in the creation of matter, it is not related, 'God *said*, Let the heaven and the earth be,' as it is related of his other works that ensued; but, simply and actually, 'God *created* the heaven and the earth:' so that the *matter* itself seems to have been, as it were, a work of hand; but the introduction of *its form* bears the style of a law, or a decree."—(*De Aug. Sci.*, vol. iv., b. i., p. 37.)

Bacon also continually protests against separating any one science from the rest, and laying down rules for it which have not their foundation in universal science, and do not apply equally to all its branches. And he reckons this as one of the chief "*impediments of knowledge*." "I see sometimes (saith he) the profoundest sort of wits, in handling some particular argument, will now and then draw a bucket of water out of this well for their present use; but the spring head thereof seemeth to me not to have been visited."

In like manner Newton asserts, that the knowledge of truth can only be attained by proceeding "from compounds to ingredients, and from

motions to the forces producing them; and in general, from effects to their causes, and from particular causes to more general ones; till the argument ends in the *most general.* This is the method of analysis. And the synthesis consists in assuming the causes thus discovered and established as principles, and by them explaining the phenomena proceeding from them, and proving the explanations." (*Optics*, iii.) And he elsewhere asserts that "the argument, by induction, is so much the stronger, by how much the induction is more general." The *most general cause*, in the mind of Newton, always referred to God; from a knowledge of God he assumed those general principles by which the phenomena were explained and proved. "When I wrote (says Newton) my treatise about our system, I had an eye upon such principles as might work with considering men for the belief of a Deity." Newton began with the being of God; he asserted that all natural philosophy led up to God (de Deo ex phænomenis disserere ad philosophiam naturalem pertinet); and he found that "it became him, who created all things, *to set them in order:* and, if he did so, it is unphilosophical to seek for any other origin of this world, or to pretend that it might rise out of a chaos, by the mere laws of nature." "Such a wonderful uniformity in the planetary system must be the effect of choice; and so must the uniformity in the bodies of animals.

These and their instincts can be the effect of nothing else than the wisdom and skill of a powerful everliving agent."—(*Optics* iii. passim.)

Bacon and Newton both insisted on the necessity of going back to the source and origin of all law, to God himself, in order to understand rightly any law—that God is the first physical principle in physics, and the first moral principle in morals. And much more imperative is this necessity in geology, where, by neglecting it, our inferences will be, not merely defective, but will become positively false: where not only the chief and most important element is wanting in the induction, but where, in consequence of this want, all the other elements may be constrained to witness the very contrary to that which is true, and to that which would be inferred from the same facts, when rightly understood.

Any geological induction which we would make sufficiently large to be true, sufficiently general to include its first cause, must ascend to God—must assume for its basis that knowledge of God which we have acquired through revelation, and make his being and attributes the foundation and the guide of all its speculations. But, together with the knowledge of God himself, we have also acquired the knowledge of his works and ways through revelation, and we cannot divide the one kind of knowledge from the other; we cannot discover by the light of

reason, or the properties of matter, how it came into being, or acquired its form, or became subject to its laws; we can only reason from things that are *as they are*—what was before, and what *they were before*, we must be told by another, by one who knew their former condition. The present and actual condition of things is the proper region of *knowledge;* the past and the future conditions are properly regions of *faith.*

It is true, however, that we may, to a certain extent, infer, from present appearances, what has been, or shall be, their conditions in past and future time; but, since inference is only *probability*, and not *knowledge*, we must neglect nothing which is indispensable to a correct inference; and, above all, *probability* must not be set up in contradiction to the things which *we know.* We know, by the same revelation which has made us acquainted with God, how the world came into being; and, as Newton argues that it is *unphilosophical* to seek for any other origin of this world than from God, so it is equally *unphilosophical* to infer anything concerning its former condition, which is not borne out by, and entirely consistent with, our knowledge of its origin. The same revelation which has given us our knowledge of God has taught us that the first condition of the world was *very good;* that the blessing of God was upon it; that the produce of the ground—the fruits, and grain, and herbs—was the appointed food of

man and all other creatures; that the dominion over them all was given to man, without any fear or dread of man being implanted in them; and that, in token of this, they all came before Adam to receive their names from him.

All this holds together as one connected narrative, of which we may not take one part to suit one form of argument, or support one kind of inference and reject other parts; but the whole must be taken, or rejected, together. And this narrative is so consistent with the other parts of Scripture, and with what we have learned of God from all revelation, that we cannot lose confidence in this narrative without being shaken in our faith on all revelation—we cannot consistently reject this part, without rejecting the whole of Scripture. Not that these men do reject Scripture, but that strict consistency would force them to do so. And not only concerning its *first condition*, but concerning the *present condition* of this world, the Scriptures are very explicit. They declare that sin changed the condition of the world; that this drew down the curse of God upon the earth which he had formerly blessed; and entailed misery upon man, and on the whole creation through him:—"Cursed is the ground *for thy sake;* in sorrow shalt thou eat of it all the days of thy life." And at length, sin having brought forth its corresponding fruit, the earth having become corrupt before God, and being filled with violence

unprecedented, God said, "The end of all flesh is come before me; for *the earth* is filled with violence *through them:* I will destroy *them* with *the earth.*" And it was not till *after this destruction* that the present condition of the world began, in all its geological, and in many of its moral, aspects. Those who believe the Bible must acknowledge, in the destruction therein recorded, a total change of the earth's surface, and an entirely new constitution of things: and also such a change in the moral relationship between man and other creatures, that the *fear and dread* of man is then, for the first time, implanted in them, and to man then, and for the first time, flesh is given for food, in addition to the fruits of the ground which had been given from the beginning. And these recorded facts consistency requires us to believe, as well as those of creation.

We do not impute to the geologists the dishonesty of being consciously guilty of the inconsistency which we show; nor do we say that they positively deny the facts which we have alluded to above; but they give these facts the go-by in a variety of ways. Many of these ways we have already pointed out, and of these we need not now speak; but we wish to direct the attention of our readers to some of the arguments which have been brought forward for the use of animal food in general, and to those also by which it is sought to prove, that it is a pro-

vision of love and mercy that animals should devour each other.

For our part, we have no squeamishness whatever concerning the use of animal food; but, following the precept and example of St. Paul, we would eat without scruple whatever is sold in the shambles, asking no question. And believing, moreover, that it was given for food after the flood, the use of it is thereby sanctioned; and what God hath cleansed, far be it from us to call that unclean. But when men are not content to leave the question thus general, or thus resting on the permission of God, but argue that it is better in theory that flesh should be used for food, both by men and carnivorous animals, and, consequently, that it might have been the food of men from the beginning, and of animals before the creation of man, we then begin to demur, and examine the arguments by which this theory is supported.

It is often asserted, as an argument in favour of the use of flesh for food, and as a reason for inferring that there were carnivorous animals designed to prey on other animals from the beginning, that by it, by the feeding on flesh as well as vegetables, a greater number of living beings is sustained than could possibly be supported if all creatures lived on vegetable food alone. In this assertion there are two fallacies, from not considering that herbivorous animals consume a far greater bulk of food beforehand

than they yield in the form of flesh to man or to the carnivorous animals, and from not considering that the carnivorous animals necessarily *displace* more than their own number of herbivorous animals, and are like the dog in the manger in the fable. Let our readers lay hold of these fallacies, and they will then find that the argument tells quite the other way.

For as men and carnivorous animals live *upon the earth*, and occupy space which would otherwise be filled by herbivorous animals, the question is, whether a greater quantity of food may not be obtained in the shape of produce, direct from the ground, than that quantity which can be obtained, indirectly, by feeding animals on the produce and using them for food. And we think there cannot be a doubt, when thus considered, that the use of animal food presupposes, in order to obtain it, the consumption and the loss of a still larger quantity of vegetable food; because the quantity of vegetable nourishment which an animal consumes is far greater than the return of nourishment which its body yields when it is slain for food. This truth comes out in the well-known fact of political economy, that a country must be *wealthy* to enable its inhabitants to live on animal food; and that in proportion as the population of a country becomes *superabundant*, and *poverty* extensively prevails, in the same proportion the consumption of animal food *diminishes*, till the people are reduced

to live wholly on vegetable diet; the difference in the superior price of meat being, in general, the exact measure of the loss sustained by the conversion of the produce of the ground into animal food. And hence in densely peopled and poor countries, like Ireland and the Indian provinces, potatoes or rice supersede animal food, as the most economical way in which life can be sustained—the way in which the largest numbers can be maintained on a limited surface; and if we turn our eyes towards earlier and ruder states of society the same results appear; for the agricultural and pastoral tribes have often been very numerous, while the hunting tribes, in scanty numbers, range over rather than inhabit immense tracts of country, in search of a precarious and insufficient subsistence.

The hunting tribes among men are like the beasts of prey among animals, roaming over solitudes which they create and perpetuate. It is a stupid libel upon law and order to call the carnivorous animals, the *wild beasts*, "the police of nature." Wolves are not the police of the fold—lawless bandits are not the police of society: the shepherd who guards the flock rather deserves the name, and represents the dominion at first given to man, and that exercised by Noah also over the congregated tenants of the ark. And this leads us to notice the second fallacy spoken of above, and to show that it is a

fact, beyond contradiction, that the carnivorous animals *displace* a far greater number than themselves of herbivorous animals, and consequently that the number of living creatures is diminished and not increased, "by adding to the stock of life all the carnivorous races." But to do justice to Dr. Buckland, and render our argument more intelligible, we will quote the whole passage from his "Bridgewater Treatise," chapter xiii., 129:

"*Aggregate of animal enjoyment increased, and that of pain diminished, by the existence of carnivorous races!*—To the mind which looks not to general results in the economy of nature, the earth may seem to present a scene of perpetual warfare and incessant carnage; but the more enlarged view, while it regards individuals in their conjoint relations to the general benefit of their own species, and that of other species with which they are associated in the great family of nature, resolves each apparent case of individual evil into an example of subserviency to universal good.

"Under the existing system, not only is the aggregate amount of animal enjoyment much increased by adding to the stock of life all the races which are carnivorous, but these are also highly beneficial even to the herbivorous races that are subject to their dominion.

"Besides the desirable relief of speedy death on the approach of debility or age, the carnivora confer a further benefit on the species which form

their prey, as they control their excessive increase by the destruction of many individuals in youth and health. Without this salutary check each species would soon multiply to an extent exceeding in a fatal degree their supply of food, and the whole class of herbivora would ever be so nearly on the verge of starvation, that multitudes would daily be consigned to lingering and painful death by famine. All these evils are superseded by the establishment of a controlling power in the carnivora: by their agency the numbers of each species are maintained in due proportion to one another—the sick, the lame, the aged, and the supernumeraries, are consigned to speedy death; and while each suffering individual is soon relieved from pain, it contributes its enfeebled carcase to the support of its carnivorous benefactor, and leaves more room for a comfortable existence of the healthy survivors of its own species.

"The same police of nature, which is thus beneficial to the great family of the inhabitants of the land, is established with equal advantage among the tenants of the sea. Of these, also, there is one large division that lives on vegetables, and supplies the basis of food to the other division that is carnivorous. Here, again, we see that in the absence of carnivora, the uncontrolled herbivora would multiply indefinitely, until the lack of food brought them also to the verge of starvation, and the sea would be crowded

with creatures under the endurance of universal pain from hunger, while death by famine would be the termination of ill-fed and miserable lives.

"The appointment of death by the agency of carnivora, as the ordinary termination of animal existence, appears, therefore, in its main results to be a dispensation of benevolence; it deducts much from the aggregate amount of the pain of universal death. It abridges and almost annihilates throughout the brute creation the misery of disease and accidental injuries and lingering decay; and imposes such salutary restraint upon excessive increase of numbers, that the supply of food maintains perpetually a due ratio to the demand.

"The result is, that the surface of the land and the depths of the sea are ever crowded with myriads of animated beings, the pleasures of whose life are co-extensive with its duration, and which, throughout the little day of existence that is allotted to them, fulfil with joy the functions for which they were created. Life to each individual is a scene of continued feasting in a region of plenty; and when unexpected death arrests its course, it repays with small interest the large debt which it has contracted to the common fund of animal nutrition, from whence the materials of its body have been derived. Thus the great drama of universal life is perpetually sustained; and though the individual actors undergo continual change, the same parts

are filled by another and another generation; renewing the face of the earth and the bosom of the deep with endless successions of life and happiness."—(*Buckland*, p. 134).

If the "enlarged view" of Dr. Buckland could discover or create two separate spheres, in one of which the herbivorous races subsisted apart by themselves, and "their carnivorous benefactors" in the other, apart in general, and only coming down to their friends in the other sphere to get a dinner among them and retire, there might be some ground for saying that the aggregate of animal enjoyment, on the eater's side at least, was much increased, and another sphere added to the stock of life. But as both races at present occupy the same sphere—as the favoured sheep, and his benefactor the wolf, both live on the same ground—and as the wolves do not eat grass, it is obvious that one wolf drives away or displaces many sheep from his neighbourhood, and that the grass which would have fed them rots on the ground. Moreover, as a general rule, the herbivorous animals are gregarious, and while feeding together help to fertilize the regions they frequent; but the carnivora in general are solitary, and the lair of each single despot is surrounded by the stillness of death, broken only by his own midnight roar.

The other part of the argument, that but for the carnivorous animals the others would die of famine, is very like a libel on Providence, as if

God had arranged matters so ill that animals must needs increase faster than the means of their subsistence. We do not believe the fact, and when we look at the comparative size of animals, whether to the whales of the ocean, or to the elephants and giraffes of the forest, we do not find that the carnivorous races are larger or better fed than these; on the contrary, it is the common remark that those animals which suffer most from famine are the carnivorous.

In this, as in all the other questions of geology, the error arises from leaving God out of the induction. If we ascribe the increase of animals to one kind of law, and the increase of vegetables to another kind of law, and go no further, these two kinds of law may clash, or one may outrun the other; but if we ascribe both to God, the two cannot but harmonize—the one cannot but keep pace with the other. For God is wise, and wisdom prescribes that, for a demand which it creates, a supply in exact correspondence should also be created. He who implanted the wants and the instincts in animals created the fruits of the earth to satisfy those wants; and if there should appear now to be a disproportion between the two, we may rest assured that such disproportion did not exist at the beginning, is not chargable upon God, nor any necessity arising out of the nature of things.

And we say the same of all plans for preven-

tion of cruelty to animals; they do not go high enough—they do not strike deep enough to reach the root of the evil. It is not by Acts of Parliament, and fine, and imprisonment, that the evil can be reached; nor is it by considerations of equity, morality, and benevolence, that it will be remedied. It is by theology alone that it can be met and remedied—by seeing ourselves, together with the whole creation, as the offspring of one common Father, and by acknowledging the evil which exists to be, not of him, but of ourselves. He, in Christianity, has provided a remedy for every evil; for the evils in ourselves, in those dependent upon us, in the whole creation: "for the earnest expectation of the creature (of the whole creation that groaneth and travaileth in pain together until now) waiteth for the manifestation of the sons of God" (Rom. viii. 19, 22). Just in proportion as men become Christians, the evil is reached and the remedy applied—as they become Christians, not in name only, but in deed and in truth—as they become merciful, like our heavenly Father is merciful. Could we bring men to be Christians indeed, there would be no need for Peace Societies and Prevention of Cruelty Societies, and the thousand other superficial remedies for evils which men feel without understanding, and treat as primary when they are secondary and consequent only. And then would our minds also become disabused of

that "philosophy, falsely so called," which St. Paul regards as nothing better than "profane and old wives' fables," and should find that true philosophy and Christianity exactly coincide; and that the Bible is not only the book of Christianity, but the book of the religion of nature—that there is no such thing as religion to be found elsewhere: that it is the record both of the history of the Church, and also of the history of the world; and that, as the blessing of the world is in every sense dependent upon the advance of the Church, so her perfecting shall be the consummation of blessedness to the whole dependent creation.

## CHAPTER III.

1. Lectures on the World before the Flood: by the Rev. C. Burton, LL.D., F.L.S.—2. Vestiges of the Natural History of Creation.

Countless are the forms of error—truth is invariably the same. In proportion as we truly know any subject it becomes more simple, the principles on which it rests become fewer, the laws by which it is regulated are perceived to be uniform and constant, and all the various phenomena range themselves under a few general, definable, and intelligible principles or laws; which, to be truly deduced from the phenomena, must be found to hold good in all similar cases without exception; for, where an exception occurs, it proves that we need some further simplification of the general principle to render it true—to render it applicable in every case—since truth is invariably the same.

That which gives to the Newtonian system of astronomy its impress of truth is this—that it brings all the heavenly bodies under one law of motion, which prevails universally on earth as well as in heaven; from the falling apple, the

observation of whose fall had suggested the thought, to the most remote of the planetary orbs—a law, too, the constancy of which we can so surely rest upon as to explain seeming anomalies which would be otherwise unaccountable, and look for variations in appearance so small as not to have been previously noticed, but which, when perceived, demonstrate the extreme accuracy, as well as universality, of the principle laid down.

The various complicated systems of astronomy, which had been promulgated before the time of Newton, were not the results of rude observations, made in a desultory manner and without a definite object: they were founded on very accurate observations, long continued in the same places, by men of the greatest ability, and ardently devoting themselves to the task of solving, by means of numerous exact observations, the difficult problem of the true motions of the heavenly bodies. Hipparchus, Ptolemy, the Arabian astronomers, and Tycho Brahe, were not rude observers: and they brought all the best means which existed, in their several eras, to bear upon the science they loved, endeavouring to establish and perfect the systems which were then thought to be nearest the truth.

Each man, in endeavouring to establish his own system, felt it a part of his duty to show that other systems had not so good a claim to

consideration; and the maintainers of rival systems could each do this work of demolition to their own satisfaction, and far more easily than they could demonstrate to others the positive truths contained in the systems which they severally held. But the Newtonian system, on the contrary, needed not for its establishment that men should take the trouble of overturning the erroneous systems which had preceded it: the positive demonstrative truth which it contained left no doubt upon the mind—it took up and incorporated everything substantial belonging to the science—and reduced the former systems into vain and empty speculations, not worthy of a thought, and in their inanity quite sure of mouldering very shortly into dust.

In order to establish the truth of his system, Newton needed, however, to avail himself of the observations of preceding astronomers. Many of the most important facts could only be known by comparison of the revolutions and changes which have been going on among the heavenly bodies for centuries. The life of one man, even though a Newton, would not have sufficed, both to make sufficient observations and to deduce the principles and laws by which substances were made to act upon each other, so as to give a consistent and reasonable account of the acknowledged facts. The precession of the equinoxes had been observed by Hipparchus two thousand years before the age of Newton; yet

the rate of that precession was not determined till our own day, and almost all the mistakes in chronology may be traced to errors on one side or the other in calculating this rate—so closely are the sciences bound together. And it is matter of doubt whether Newton himself, had he lived in an earlier age, could have brought out the truths which we owe to him—so exactly does Providence adapt the age to the man, and provide the required man for the age.

Though accurate observations had been made for more than two thousand years, and these had been classified and arranged so as to give a scientific appearance to astronomy before the age of Newton, we now perceive and acknowledge how very small was the proportion of truth—how little of real science there was in all that had been done: the secondary position of the earth, and its true relationship to the other bodies in our system and in the universe, was quite mistaken—or, to speak correctly, entirely unknown. If such was the case with respect to the position of the earth, and its motion among the other planetary bodies, what shall we say to the question concerning the *Creation* of the earth, and the agency by which it assumed its present form, and by which the materials of which it consists assumed their several relative positions? The science which professes to treat of, nay to demonstrate the certainty of, these primeval transactions, which

are boastfully asserted to have taken place before the creation of man—this science itself can scarcely be called half a century old: it is yet in its infancy—is certainly not so much advanced as astronomy was in the days of Hipparchus. All the old geologists of this day must remember the time when geology was not —existed not either in name or reality—must remember the time when Smith, the "father of geology," had not made public the classification and succession which HE *first* noticed as prevailing among the echini, &c., of the chalk and adjacent strata. And the labours of half a century are not competent to observe all the facts, even of the surface of England; to say nothing of the greater depths of the earth, or the thorough investigation of other lands—all of which need to be explored again and again before we shall have facts enough before us to place geology on a respectable footing as a science.

When all this is done it will be time enough to speculate upon the how and the wherefore—how things came into their present position, and wherefore they had the forms which they now present. But we very much suspect that a better acquaintance with the facts will leave no such questions to be solved—that the facts, rightly understood, will speak for themselves. And in the mean time we have very little solicitude for the result: there may be counterparts

of Ptolemy, and Tycho Brahe, and Des Cartes, in geology; whose systems may find supporters, for a time, among those who mistake the energy of party zeal for the conviction of truth; yet a time may come when some counterpart of Newton shall arise, and, bringing to light the true principles which may reconcile all the facts, at once put all the preceding crude speculations in the shade, and render geology simple and consistent, like astronomy.

In proportion as men become enlightened they are taught humility and diffidence, concerning not only the value of their own discoveries, but those of the age they live in, towards accumulating sufficient facts to perfect the science in which they have rendered themselves eminent. In that department of geology which has furnished all the data on which the speculations of the moderns are grounded there is no name occupying a higher place than that of the Baron Cuvier. Yet he, in concluding his great work, "Ossemens Fossiles," writes as follows:—

"I have no doubt but that, in proportion as the discoveries already commenced shall be completed, new discoveries will be multiplied, and that, perhaps in a few years, I might be obliged to acknowledge that the work which I this day terminate, and to which I have dedicated so much labour, will appear but a superficial view—a first and hasty glance cast over the immense creations of ancient ages."

*Ars longa, vita brevis.* Geology will prove no exception to this general adage. We must content ourselves at present with watching the progress of this new science—this science, the birth of which is more recent than our own, whose years we can number, and which we have accompanied in its growth. The novelties, the startling discoveries, cannot but claim, and their importance cannot but fix and rivet, our attention; but we must be patient, and not expect at once to understand how these things came into their present condition, and still less what was their condition in circumstances unknown to us, unlike anything we know. Some general laws will in due time appear, by the application of which, facts, at present seeming to contradict each other, will be reconciled, and others which are at present inexplicable will become intelligible: for this it is our wisdom to wait. Yet, in the mean time, it is our duty to point out the extent and the limits of our present knowledge, to show how far all may confidently proceed in their affirmations, and where is the point at which the boldest ought to pause, and confess their present ignorance. Above all, it is our duty to watch unceasingly, and defend even to the death every bulwark of our faith, many of which have been assailed by rash speculation—some of which have been for a time yielded by weak or injudicious advocacy: and we have to remember also that an enemy

may work effectually, by sapping and undermining, though it may be unobserved; and that, if an entrance be gained stealthily, even through a postern, a lodgment may be effected which, if not fatal, may require all the strength of the garrison to resist; and which, if not resisted, would most assuredly prove itself, at length, fatal, by eating out the very principle and vitality of faith.

Sound theology and true philosophy must ever be in harmony with each other: if either seems to be contradicted by the other, we may rest assured that something is wrong there. In any case where religion and science seem to be irreconcileable, there must be mistake on one side or the other; either theology is defective and its bearings are misunderstood; or philosophy is shallow, its deductions partial, and confidence misapplied. We say not *false* in either case, because we are not dealing with wilful perversions of the truth: the mistakes to which we are addressing ourselves are, for the most part, traceable to limited information, or partial views of the subject, and should be corrected by pointing out the deficiencies, rather than by grave rebuke and sharp reprehension.

Theology has for its aim and end the discovery and inculcation of correct principles concerning God, both as the Creator of all things, and as continually overruling by his

providence all the things that he hath made. And this especially as these attributes of God have been displayed towards man—a creature made in the image and likeness of God, and the last, the chief work of his hands. Philosophy has the same aim and end of teaching us what God is; but, instead of beginning with God, and descending from the abstract to the particular, it begins from visible things, and laying hold of their ascertained laws and properties reasons concerning these mutual relationships towards each other, so as to discover the common relationship which they all may bear to the one universal source or centre—to the one great cause of all things. Theology has not done its work until it is able to give such an account of the attributes of God as will explain what we see around us, and will be consistent with his having created and continually superintending that course of things which we daily experience. Nor has philosophy done its work until it can account for the origin of those visible phenomena, and the far more difficult and mysterious workings of the human heart, which give meaning and intensity to everything else: so as to make all things appear consistent with those worthy thoughts concerning God which natural reason, unaided by revelation, would suggest—such, for instance, as we may find in the songs of Orpheus, or the discourses of Socrates and Plato.

The theology of which we speak has of course revelation for its basis, because we can know nothing whatsoever concerning what God is, save as he himself makes it known to us. The strange notions which man, left to himself, has formed sufficiently evince this; and reason or philosophy, in their utmost perfection, have never been able to go beyond the inference that *there is a God*, and that there can be but one first and greatest of beings; but that God hath those attributes in himself, and those methods of dealing with his creatures, which theology treats of, we should never know, if God had not revealed these things to us. And theology also informs us that these revelations are made, not merely to gratify curiosity, but to make us acquainted with the origin and connection of the goodly framework and machinery of the universe, in order that we, as part thereof, may fall in with the purpose which God is accomplishing thereby; and, fulfilling our present duties, may be in waiting readiness for the winding up of that which remains of present time, and the development of that glorious futurity which God has also spoken of—that kingdom of heaven in which all that is at present doubtful or obscure shall be made clear, and all that is now incompleted shall be perfected, and those who rightly employ the present time of preparation shall receive an eternal reward, and enter into the joy of their Lord—a

reward commensurate with an enlarged capacity in man, and, therefore, such as, in our present condition, eye hath not seen, nor ear heard, neither hath it entered into man's heart to conceive.

And philosophy itself, the more it advances, and the truer it becomes, is only the more obliged to have recourse to theology, and acknowledge such a first cause as we mean by God. For when we have pushed our investigations to the utmost, we always find that, both in immensity and in minuteness, there are regions which appear to be infinite and unfathomable, where the hand of the same God still is seen: the mere numbers and forms of being that appear are beyond calculation or conception: and in every one of them, however simple, we find a limit to our knowledge beyond which philosophy cannot carry us, and where we are constrained to acknowledge—this is the finger of God. Professor Owen, in one of his addresses, well observed:—

"Everything is great or small only by comparison. The telescope teaches us that our world is but an atom, and none know better than microscopal observers that every atom is a world. If the astronomer be led, from the contemplation of the countless orbs that traverse boundless space, to the adoration of the Creator in his almightiness, so the observation of the perfections of his minutest works, which,

though invisible to ordinary ken, unfold new perfections with every increased power of observing them, ought to impress us with a lively sense of that all-caring-for and all-seeing Providence, without whom not a sparrow falls to the ground, and by whom every hair of the head is numbered."

And in every blade of grass, and in the most simple of the mollusks, or the most minute animalculæ, in all organized beings whatever, there is a principle of life beyond the organization, and wholly independent of it, concerning which we know nothing. So also mere matter has its laws, such as gravitation, polarity, chemical affinity, and so on—the operation of which we may note, but the principle of which we cannot by any means discover. For there is a point in every science beyond which we are unable to carry our investigations: the point we may shift a little further back, but beyond it we cannot get, and are constrained to say—this is beyond the creature itself, and must be attributed to some higher power. The *operation* of the laws which belong to every science we are able to trace; but *the laws themselves*—that power by which these operations go on so uniformly and constantly that we are able to trace each operation to a fixed principle or law—this we can only ascribe to God. What is gravitation, or polarity, or chemical affinity? They are at present only names for certain

operations. Who taught the animals their several instincts? Why do birds build their nests, and bees form their cells, alike in all countries where they are found?—nay, birds in cages who have never seen a nest, and are not in a natural state? These powers—these instincts—are of God.

First principles and laws of being, moreover, are usually compensations one of another, which for their operation require the nicest adjustment, with an abiding counterpoise for continuing their uniform action. These laws also are generally contrary to the natural tendencies of the bodies upon which they act, and often two or more laws are in operation at the same time, in antagonism to each other, yet preserving an exact equipoise. It is by the balance of opposite principles, keeping all things in such wonderful harmony, that the contemplative mind is most forcibly affected, in studying that goodly portion of the universe which is within the reach of our investigation; and from this contemplation we rise with the conviction that laws which are contrary to the natural tendencies of the creation cannot be self generated—cannot be of it—but are of some power higher than it—independent of it. And in contemplation of the universality, and constancy, and omnipotence of those laws, we arrive at the further conviction that the Author and Sustainer of all things is God. The region of in-

tellect also, like that of sense, has its laws and its limits, beyond which it cannot carry its metaphysical enquiries, yet is constrained to acknowledge that God is above and beyond. God is there, but equally unknown to all who expect by searching to find him out—whether the confession be made by shrinking from him in superstitious dread, or discoursing philosophically concerning a Being shrouded in light inaccessible, or dwelling in heights above and depths beneath, unfathomable to the comprehension of all created, all finite intelligences, whether human or angelic.

Looking at that portion of creation with which we are best acquainted, and enquiring concerning the present constitution of the earth, philosophy cannot explain how it happens that there is any dry land at all. It is contrary to the natural tendencies of earth and water that any dry land should appear. The earth is the heavier element of the two, and at the beginning it must have been under the water; and, left to itself, it would always have remained lowest, and the water, as the lighter, would for ever have covered the surface of the earth. Natural causes fail in accounting for the existence of land, and are opposed to its existence: therefore, reason is obliged to resort to a supernatural cause—that is, to the Author and Controller of natural things; and revelation comes in aid of reason, and tells us that it

was brought about by the word of God. God said, "Let the waters be gathered together, and let the dry land appear." And it was so. Philosophy and revelation coincide in ascribing the mere existence of dry land to the power of God; and when we look to the living creatures inhabiting the earth, and rise above inanimate existence to contemplate life in any of its various forms, the proofs of the agency and continual presence of God become so much the more numerous, and clear, and cogent. Vegetable life, from its lowest to its highest forms; and much more animal life, with its sensations, instincts, thoughts, affections, and powers—life, in all its forms and modes of action—implies, both for its origin and for its continual exercise, creative and providential attributes, which can be ascribed to none other than God alone. There is such a witness for God in the adaptation of each creature to its place, and that a place already prepared for that creature—such a oneness of mind and foresight of all contingencies—such provision made for each living thing in the varied constitution of matter, and such conformation and adaptation of all living things to avail themselves of that provision, that there is no better help to devotion than the contemplation of this universal harmony. Natural theology is one of the most constant handmaids of religion. The Psalmist, in adoration of the Creator, sometimes lifts up his eyes to the

heavens, the work of God's hand—to the moon and the stars which he hath ordained. At other times his worship is directed to him who giveth to the beast his food, and to the young ravens which cry, saying, "All thy works shall praise thee, O Lord; and thy saints shall bless thee; the eyes of all wait upon thee; and thou givest them their meat in due season. Thou openest thine hand, and satisfiest the desire of every living thing." And our Lord himself directs our contemplation to the same subjects as incentives of our faith, and to increase our confidence in God—"Behold the fowls of the air, for they sow not, neither do they reap, nor gather into barns; yet your heavenly Father feedeth them."

The point we start from—the point we desire to impress upon our readers, that they may bear it constantly in mind—is this: that there is an order and adaptation to the place they occupy in all things, so as to evince power and intention in such a way as to lead up to God, the Creator and Governor of all things. And then we must be consistent, and having, from the manifest order, inferred that God had wrought in these things, expect to find order in all the works of God. And as the evidence of intention, which appears in the things that we *do* understand, has led to the inference that *these* have had an intelligent Creator, so we should not rest satisfied with any explanation

of the things which we *do not understand*, except this also implies intelligence and purpose in the Creator. Every act of creation must result from a purpose, and evince an order and a plan—we cannot allow that anything has been left to chance. Nor does true science any more than theology admit such an element as chance: we may be ignorant of a law—it may be above our comprehension—we may be constrained to ascribe the act to God; but it is quackery only that resorts to chance: where knowledge ends there causation begins, which is only another name for the one God.

When, by the necessity of being consistent, we are thus forced to require proofs of order and intelligence in any admissible or credible account of the creation, reason shuts us up to some such account as that which is contained in Scripture, common sense ought at once to reject any other theory of creation, however plausible: for our knowledge, derived from natural theology, requires that the Creator shall have prepared a place for each creature, and placed each creature in the situation intended for it, in full possession of all those qualities, faculties, or endowments, by means of which it could at once enter upon its destiny, both of receiving from, and ministering to, other creatures, in that progressive scale and connected chain of being which the creation, contemplated as a whole, presents to our admiration and gratitude.

Man and all animals were, of course, created in full maturity; not only because it is reasonable to expect that the Creator would bring them into being in full perfection to show his intention by them; not only because thus only could they occupy their place in the scale of being, and show their true relationship to other beings above or below them, but also from the necessity of the case; for children and the young of all creatures are helpless, and even in their best estate—even in paradise—they would require to be fostered by parental care. And plants were created in their full size, and all laden with their proper fruit; for these were created for the sustenance of life, and man and the animals would need food as soon as they were brought into existence. And the earth was created in such variety of hill and dale, and such diversity of soil and climate as might be requisite for the growth of the various species of plants, each of which species is adapted to certain races of animals, who also instinctively frequent those regions where the plants fitted to their sustenance thrive the best—whether it be the mountain, the plain, or the morass.

In contemplating the works of creation, as existing at the present time, we cannot get much beyond the point at which we have now arrived when reasoning from the external world alone. In the visible creation we find such proofs of design, and such wonderful adaptation to the place which each is intended to occupy,

and such a chain of connection binding them all together as one whole—the product of one universal mind, that we assent to the truth of natural theology, and ascribe the creation of all things to God: and we rest so firmly on this ground as to refuse *in toto* the admission of such elements as are only the result of accident or chance. We cannot but ascribe to God alone the origin of all things, and to him alone ascribe those properties and laws, both of matter and of life, which are implanted in each, according to its kind, and keep each in its own place, and enable it to discharge its appointed functions. We do not mean to address ourselves to any that refuse to go with us thus far: since we think that the truths of natural theology are placed by Paley and others on grounds so distinct as to be beyond reasonable doubt or cavil. The disbeliever in an intelligent Creator is only deserving of a place in the incurable ward of Bedlam, and the man who does not include the properties and laws of all creatures in the act of creation is not a correct and consistent reasoner.

But God having made all things, and that at once in full maturity or perfection, in order that the several properties or instincts with which each was endowed might come simultaneously into operation (which we must assume, because these properties and instincts form the conditions upon which the subsistence of all things

depend), we have no scale or measure in the things themselves from whence to calculate the time when they first came into existence. If the earth was created with hill and dale, mountains and plains, rivers and seas—as it must have been, that streams might flow to water the earth, and plants might have their appropriate soils and climates—then these hills and this variety of soil afford no criteria for judging of time. And if trees were created of full size, to cover the earth and yield to animals their food, it follows that the size of trees affords no criterion for determining the time when trees began to grow; for, on the morrow after its creation, the oak of yesterday would present the appearance of those oaks which may have required, in the course of nature, the growth of a thousand years. And if animals were created full grown, and in numbers proportioned to the plants severally assigned to them for food, then neither the size nor the number of these are any index of the time when animals were first called into existence by the Creator. Moreover, respecting the classification of plants and animals, which is remarked in those strata of the earth which contain organic remains, we should remember that such a creation as we are speaking of ensures a sort of classification, by the congregating of numbers of the same species into those localities where only the plants destined for their food will grow. The mountain air and

its climate, which certain plants require for their existence, are also congenial to the habits and feelings of the animals which feed upon the products of the mountain; and so of the plain or the morass—they are agreeable to the constitution of those species that inhabit them. And even in the depths of the sea we have no doubt that there is a classification, and that fishes of different tribes prefer living at different depths, induced by natural conformation, and attracted by the food which they prefer being there to be found. In such considerations as these we have no doubt that sufficient materials will be found for checking the over-confident speculations of modern geology touching the structure and quantity of their stratified deposits, and the number or classification of organic remains, with the true relation they bear to the first constitution of the earth, and the nature of the convulsions or changes which have since taken place.

Whatsoever the facts may be which geology shall bring to light—whatever the inferences which may be drawn from such facts concerning the primeval constitution of the earth—these are all necessarily of secondary importance, and of inferior weight to those considerations of which we have just been speaking; for we have been speaking of actually existing things, and our reasoning has been grounded upon laws at present in operation, and facts which we daily witness: but geology can only be cognizant

of the results of operations which have long ceased, and can only infer, from present appearances, what might have been the case under circumstances which no longer exist, but which must have been confessedly very different from any within our present experience. Appearances may deceive—inferences may be false—other facts may exist, and future discovery may bring them to light, which may prove your inferences to be erroneous. Nay, the very point which geology requires us to concede in the first instance, and without which it cannot take a step —the agency of volcanoes and earthquakes—is a point which we cannot allow in any scientific enquiry—in any deduction of principles or any systematic account of facts; and this because in such kind of agency there is no law, no principle to be found at present, and it would be only escaping one difficulty by getting into a far greater. Geology would have us commence with disorder and chaos, and at every step would have recourse to volcanoes and earthquakes, which are the very opposite of principle, order, and law—whose every action is mere violence, with no rule but that of a greater opposing force; and which acknowledge no control, save the exhaustion of an explosive power, or the termination of a stream of lava and scoriæ—strange elements these to form the basis of any system, save in the fabled kingdom of misrule and the regions of chance!

The principle that God hath made all things, and impressed upon them those laws which we behold now in actual operation, we insist upon in every enquiry; because this principle is established on a foundation which nothing can shake: and if any of the facts of geology seem to contravene this principle, we say, without the least hesitation, that those facts must be misunderstood: but, for ourselves, we say that, though we have carefully watched the progress of geology from the time that it first began to take the form of a science—that is, from the days of Werner, Hutton, and Smith, with their noble coadjutors, Hauy, Cuvier, and Agassiz—we know of no such contravening facts. That many of the *explanations* of facts contravene this principle we freely allow, but these explanations are quite another affair; for of the same facts we are prepared to give very different explanations whensoever we shall think the proper time is come—explanations by which, we are bold to say, that all the facts may be shown to be consistent with principles of science which are acknowledged, and with Christian theology.

And, as in the creation and first disposition of all things we insist upon the recognition of the hand of God, so in any great disturbance of that order—in any general change—in any universal catastrophe, consistency obliges us to require the same Almighty hand to suspend or alter the

laws of the universe, as at the first to impose those laws. We find everywhere traces of an universal deluge: this could not come by any natural means—could only be brought about by temporary suspension of, and interference with, the present constitution of things. But, ascribing this to God, we expect to find even here consistency with the other acts of God, and that a cause for this interference shall appear, which shall bring it into accordance with those principles by which we are taught that God hath ordered and governed all things. We will not allow that the world has been abandoned at any time to chance, since this would amount to allowing that it was taken out of the hand of God for a time, to be taken in hand again by him when that turmoil of chance should be over. It is unphilosophical to suppose that God has ever relinquished his hold of the things that he has made, or ever relaxed the superintendence of creation's laws, for it would be tantamount to saying that the creation thus relinquished is no more, and that a new creation begins when God resumes his superintendence; and it is tantamount to saying that of the former creation we can know nothing, for it would be virtually separated from all our present experiences by that godless blank—that supposed chaotic hubbub — that trackless, purposeless, fathomless abyss of anarchy which we find to be the pervading idea of all the modern systems

of geology. The earthquakes, volcanoes, and deluges of which we have any present experience are on so small a scale, in comparison with the surface of the earth, as to be mere exceptions to the general law, or at most partial evils for universal good. These can occur without breaking down or violating the general laws under which the whole creation is bound together; but the universal and reiterated catastrophes, which are assumed as the basis of geology, could not take place without the utter subversion, for the time, of all those laws of matter by which the different substances are maintained in their several positions, and under which conditions alone the life of all the creatures with which we are acquainted could be continued.

The deluge, like the creation, we ascribe to the immediate power of God, put forth, on that occasion, in a manner as orderly for the destruction of the world as it had been put forth at the beginning for its creation. And because we can trace order in the facts brought to light by geology, we expect to understand them in due time, and to find the deluge of Noah to have been an important agent in producing that state of things which those facts disclose; and to find also that the same laws which are now in operation have remained inviolable, both during the catastrophe itself, and before the time when it took place. When man sins, it

provokes the judgment of God, and to that man God seems to have changed, when it is he that has shifted his place. The Creator does not change when the creature changes; but the change of the creature makes those laws, which had operated for good before, become, when it has deteriorated, instruments of evil.

In geology, as in every other science, certain data are presumed, as established by previous observation, from which data all our investigations proceed in analogy with recognized general principles, in order to ascertain how the geological facts are connected with each other and with science in general; so as to account for what is already known, and to assure ourselves that under similar circumstances similar results will always appear. We must assume that the materials of which the earth consists remain the same in quantity and in kind under all circumstances, and that where several substances are combined none of the original elements are changed—none of them are lost; but each simple substance may be made to re-appear, with all its own properties, undiminished, by careful analysis or decomposition. This fact, concerning the indestructibility of matter, has been frequently and most satisfactorily demonstrated by chemists and mineralogists, and forms the basis of all accurate reasoning in geology. But thus taking it for granted that the primary elements exist, in fixed and definite

quantities, and each retaining constantly its own properties under all circumstances, and in whatever variety they may be combined, geology endeavours to account rationally for the appearances with which an accurate examination of the earth's surface has made us acquainted, both as to the separate formations regarded singly, and also as to their relationship towards other formations and to the earth as a whole. Man can neither create nor destroy: none of the resources of science are able to add to the quantity, or change the properties, of the primary elements of nature: we only more simplify or more combine things already existing.

The dreams of the alchymists, concerning the creation or transmutation of metals, are no longer worthy of a thought.

Gravitation itself—the most universal law of matter, and the law which most of all bears upon the question of geology—can only be rendered comprehensible by assuming that all known space is filled with atoms infinitely small, yet indestructible in their ultimate unity; and that, in consequence of this indestructibility, one set of them striking upon another set produces that uniform motion of all bodies towards other distant bodies, and of the particles of each body towards its own centre, which we call gravitation: for, as each atom which received a blow would shield another atom from such a blow in that direction, while the atom shielded

on one side would be receiving blows on all other sides, impelling it towards the atom which shielded it, and which itself was being driven towards the atom shielded—so the law resulting from such a supposition would be precisely that which we know experimentally to be the law of gravitation: the joint action upon the two atoms would cause any two bodies, consisting of aggregations of such atoms, to rush towards each other with a force which would be direct according to their masses—inverse according to the square of their distance. But this supposes that the atoms which are impelled, and the atomic power which impels, are equally indestructible and constant.

Again: the brilliant discoveries of Dalton, concerning the definite proportions which are uniformly found in all chemical combinations, cannot be dissociated from the persuasion that the ultimate particles of all bodies are distinct in nature, unalterable in their properties, indestructible as to substance. The conviction that it is so, greatly shortened Dalton's path—greatly facilitated his discoveries; and to us they can scarcely be rendered intelligible without adopting substantially, and to a practical extent, Dalton's own convictions concerning atoms. His first decisive experiments were made on elastic gases and the air we breathe—regions in which we should least expect to find ponderable, definable, indestructible particles of matter: but finding

the law of definite proportion and indestructibility to be constant in the thin air we breathe, and substances invisible, impalpable, and ethereal, it was a comparatively easy though unexpected, yet conclusive and satisfactory result, to trace the universality of the same law throughout all the combinations of matter.

Men already knew that in all combinations of two or more substances it was of the utmost importance to find out what were the best proportions of the different ingredients—how the acids could be employed with most effect, or when they might be entirely neutralized—what proportions of the metals gave to brass or steel its best temper for the use of man—and from what mixture of ingredients we might most closely imitate the crystal in its clearness, and the colours of the gems and the flowers. They also knew that, in some of the combinations of art, union took place, up to a certain extent, without increasing the bulk of the larger substance by the addition of the smaller: water, for instance, will receive a considerable quantity of salt without increasing its bulk; and copper in a state of fusion may have ten per cent. of tin incorporated with it, yet the compound only occupy the same space as the copper did without the tin; the one substance being, as it were, absorbed within the pores and interstices of the other, and adding to its weight, yet not increasing its bulk. Dalton found that where

two substances were thus capable of uniting, the proportion which the one bore to the other was always either precisely the same, or such a proportion as would result from multiplying one of the ingredients in the first combination, and no other proportions would combine. Thus, supposing ten per cent. of tin to enter into combination with copper, if any further combination be possible it will not be of twelve per cent. or of fifteen per cent., but of twenty per cent., thirty per cent., or some multiple of ten, as being that proportion which appeared in the first combination. And a still more remarkable fact was also brought out by Dalton—namely, that in those combinations of elastic gases—from experiments on which it was that these laws of matter were first deduced—the particles or atoms thus combined still retained their distinctness in some respects: so that each particle presses upon its kindred particles alone, and not upon those of the other substance with which it enters into combination—neutralizing, as it were, the effects of gravitation on the compound as one mass, but retaining those effects on the several ingredients of the compound. Or, taking common water and the air we breathe for our illustrations: water, in all situations, consists of the two ingredients oxygen and hydrogen, and the oxygen is always precisely eight times the weight of the hydrogen, the particles of each being kept in equal diffusion by the oxygen

pressing *solely* on particles of oxygen, the hydrogen *solely* on particles of hydrogen: and this quite independent of the water being pure or foul; because all impurities are *mere mixtures*, and we are speaking of the elementary constituents of the water. In consequence of this law the oxygen, which is heavier than the hydrogen in the proportion of eight to one, does not subside, nor the hydrogen rise to the surface of the water, but they remain in equal combination throughout. And so in elastic compounds, such as the atmosphere, the oxygen and nitrogen are of very different densities, yet they remain in equable diffusion, because oxygen repels *only* the oxygen, nitrogen *only* the nitrogen; and thus, in the lower and higher strata of the atmosphere, the composition remains the same. "When two elastic fluids (says Dalton), denoted by A and B, are mixed together, there is no mutual repulsion among their particles—that is, the particles of A do not repel those of B, as they do one another; consequently, the pressure or whole weight upon any one particle arises solely from those of its own kind."

Dalton believed that the experiments he had made, with such uniform results in all cases, were sufficiently numerous to warrant the conclusion that these properties and laws *pervade all matter*, and afford an explanation of the order and connection which subsist among the primary elements of all terrestrial bodies: and Sir

Isaac Newton, who had formed his opinions mainly from the contemplation of celestial bodies and the laws by which their motions are governed, arrived at a conclusion which is substantially the same, saying—"All things considered, it seems probable that God, in the beginning, formed matter in solid, massy, hard, impenetrable particles, of such sizes, figures, and with such other properties, and in such proportion to space, as most conduced to the end for which he formed them; and that these primitive particles, being solids, are incomparably harder than any porous bodies compounded of them; even so very hard as never to wear or break to pieces, no ordinary power being able to divide what God made one in the first creation."

Geology will not take its place as a science until its phenomena are so far understood as to fall into some agreement with these principles and laws by which all inert matter is regulated; everything having found its place by a species of instinct, and everything being kept in harmony by the constant operation of the same universal constraint. And yet other phenomena come also into consideration, which prove that these laws are not of matter itself, not self-generated or self-sustained, but implanted and superintended by One who is above and beyond them all, and is by them accomplishing other and higher purposes—One who is making known his own being and attributes, and exer-

cising moral government in accordance with that being and those attributes. The *disturbances* of order in the works of creation—which are quite as remarkable among geological phenomena as are the *proofs* of order—are as necessary a part of the problem to be solved; and the geologist has only done half his work when he has explained the *orderly* part of his subject, and abandons us to chance for the *remainder*. On the contrary, we, knowing this *last part* to be the most difficult, believe it also to be the test of the truth of all the rest of the explanation; and, if it will not stand this test, we reject the explanation altogether. If the heavenly bodies obey these laws in their vast orbits; satellites around planets, and these around their suns, and all suns keeping their relative places; and if the minute particles of matter, and the very constituents of the limpid water and viewless air answer to the same general laws, in measure and in weight—much more do we require their application to be recognized in the mountains, rocks, and strata which form the solid crust of the earth, and where, in an especial manner, such universal laws should have their manifestation.

And in every attempt to explain the order of created things, *the act of creation* itself must be taken for granted. We presume that the things exist, each with its own properties, constituting the distinction between it and all other matter:

these primary elements themselves are not within the reach of science: we cannot account for their origin, but assume them as the basis of all our reasoning, and the foundation of the science itself. Science, properly speaking, is the knowledge of the primary and permanent qualities of each substance, and the manner in which, by means of these qualities, simple substances operate upon each other, and either seem to change or enter into such combinations as to put on new appearances. It is mere quackery, and not science, to speculate upon what these things might have been before they took those forms, and were endowed with those corresponding properties which the state of our knowledge at any given time makes us sure of: our knowledge may increase, and enable us still more to limit the number of primary substances, and still more to simplify the general laws by which these are to be governed, in their reciprocal action upon each other. But genuine science never goes beyond actual knowledge—never deals in mere speculation. Speculation may impiously assert that all things came by chance; but honest science, truth-telling science, whose only object is truth, laughs at the folly of such speculations. Science knows that out of nothing nothing can come; and that even after you have dead matter, this left to itself remains dead: it cannot produce any result: life, or some agent to give motion, is necessary, and

this under the control of fixed and determined laws, before it could bring about any of those results which form the first elements of our knowledge, and lie at the foundation of science. And where speculation would be absurd, or must necessarily fail, natural theology comes to our aid; showing in all the things which we behold traces of intention, and accommodation of provisions in a most wonderful manner to definite ends, and those ends benevolent, to obtain the utmost enjoyment for the creature. Moreover, combining science with natural theology, we may advance a step further, and behold the things around us, still in the hands and under the control of One mightier than they—of One who saith to the sea, "Hitherto shalt thou go and no further, and here shall thy proud waves be stayed"—of One who wields the thunderbolt, and holds the wind in his fist—who bids the earthquake open its mouth, or the volcano pour forth its torrents of fire, or the deluge of waters cover the earth.

And just where natural religion must necessarily terminate revelation takes up the strain —carries us onward in the theme—shows us who and what is the Being that hath made all these things, and hath them all under his control—tells us wherefore they were made—for what purpose they are kept under control—what are the laws by which the moral government of the universe is regulated, and why there

hath been any interference with what may be called the regular course of nature. And to put these declarations concerning God's moral government beyond a doubt or question, similar interferences are recorded as historic facts—in an universal deluge; in the destruction of Sodom and Gomorrah; in the dividing of the Red Sea; in the swallowing up of Korah and his company; in the long list of such interferences in behalf of the children of Israel: and, above all, in the acts of Christ the Lord; who, invested with the power of God, manifested it in every possible way, and often in the control of those elements of the creation which lie beyond the reach of science; so that the spectators cried out in astonishment, "What manner of man is this, for he commandeth the winds and the sea, and they obey him!" We are Christians—we believe in the miracles wrought by our Lord—we believe all his words, and he continually appealed to the mighty acts which had been done in times of old—to the deluge—to the destruction of Sodom—to former miracles of the same kind for the same end: all are alike bound upon us by our faith as Christians.

Nor let the mere naturalist say that this appeal to revelation is out of place; for no other account can possibly be given of the present constitution of the earth than one which admits of an agency which is *supernatural.* Things actually *are* in situations where they could not

have placed themselves at first, and where they could not remain at the present time, save by the overruling of their natural properties and known laws by some power superior to these; contravening them in the first instance, and resisting their tendencies ever since. And who can contravene or resist laws ordained by the Creator but he himself? What, for instance, can be a more general law of nature than gravitation?—namely, that bodies heavier than water should sink—bodies lighter than water should swim: and that when bodies of different gravity, yet heavier than water are dissolved, they should subside to depths corresponding to their relative weights? But none of these things are so. For all the earths and stones which form the land are heavier than water; therefore, by the laws of nature, there should be no dry land—no earth or stones above the level of the sea. The whole globe, if left to arrange itself according to the laws of gravitation, would have been entirely covered by the sea; and even now, if left to the unrestrained action of those laws, would, by the natural tendencies of earth and water, speedily return to a condition in which neither men nor animals could subsist; and ere long, by the laws of gravitation, the heaviest bodies would reach the ocean, and be arranged one above the other according to their specific gravities; and one uniform sheet of water, varied only in its depth by tidal

forces, would cover the whole surface of the earth.

And in scientific investigations, and when philosophising on the laws of matter, geologists cannot legitimately introduce volcanic and other irregular agencies, which either have no limits and are under no control, or the laws of which are at the present time wholly unknown. We can allow a place for these or any other unlimited powers *in the hand of God*, and where he is allowed to be the immediate agent, because he is then both the reason and the law: the recognition of the presence of God assumes a reason why he should be present—assumes that there is sufficient cause—*dignus vindice nodus*; and assumes also limitation and control over everything, in the presence of the Almighty, to accomplish his own purposes. But in any discussion of the laws of nature, and any enquiry into the mode in which we may explain how the earth took its present form, we can only advert to volcanic and other irregular agencies, of whatever kind, in order to exclude them altogether; and we protest against their being introduced at all into such a discussion, and assert that the introduction of such unknown, such inexplicable phenomena only tends to mystify and to mislead. For these are not laws of nature: all that we know of them is that they are disorderly—they are disturbing forces merely—they interfere with the only

means of solving the problem—the regular order produced by established laws. They must, therefore, be disregarded—nay, carefully excluded—from every enquiry into *natural* causes and effects, and only employed to fortify the argument in favour of the continual interposition of God, both to counteract the continual tendency of earth to sink and water to rise—the natural tendency of all things to find a level, and also to counteract the utter subversion of all order, and the obliteration of every trace of intention, in which volcanoes uncontrolled must necessarily terminate. And earthquakes and volcanoes, if partial only, and not to the extent of destroying all order, would themselves be neutralized, in such a case, as all matter left wholly to itself, in obedience to the natural law of universal gravitation. *After* the dry land had been separated by the hand of God, partial volcanoes might occur *on that dry land*, and the effects might be permanent in that locality; but this assumes the very point in question—assumes a separation to have been made, and to be still maintained by a power *beyond that of nature*, counteracting the natural tendencies of matter.

We, therefore, maintain with the utmost confidence that an agency superior to, and counteractive of, the natural tendencies of earth and water, lies at the foundation of geology as a science, in order to account for there having

been any dry land at all to begin with; and does *prima facie* appear in every stratum that has been since deposited, whensoever that stratum rises above the level of the sea, or indicates any other departure from the laws of specific gravity. The Being who created all things, and gave to them all their several properties, and appointed the laws by which they are governed, is the only Being whom we can reasonably invest with the power of overruling and counteracting the laws of creation: the *Overruler* is the more powerful Being—overruling is the attribute of the Almighty—there is but one Almighty, and he is the Creator—he also is the Overruler—he is the one God. Discarding for a moment from our view all consideration of time, the world must have had a beginning: there was an eternity in which the Creator alone existed, and when the world was not. Who knows how the world came into being? Can the earth tell us, or is it written in the sea, how they came into being, and how long there existed nothing save earth and sea? Can the fishes tell us—can all creation tell us—can man, confessedly the last and noblest act of creation, tell us, how, when, and wherefore he was made; and how, when, and wherefore all other things were made, before any living creatures appeared on the earth? Confessedly they cannot. Retrospect, like prophecy, requires the omniscience of God.

But geology, instead of acquiescing in these negations, and seeking information where alone it can be found, namely, in revelation: geology, instead of being satisfied with this, grounds *on these negations* a system, the result of which is a denial of all the truths of revelation, throwing our ideas loose upon the wild sea of chance, without compass, or chart, or time, for guidance or computation. The fundamental assertion from which they start is, that man was *not* in that world which they profess to explore, and during that time which their investigations cover: our only true link with that world is assumed to be wanting—it is supposed to be wholly cut off from our knowledge and our sympathies! The next fact they profess to give us is a *negation* concerning the existence of the present races of animals—it is supposed to have been tenanted by races *wholly extinct*, and that *none* of the present animals were there! In the vegetable and mineral kingdoms similar *negations* are continued—the plants, the climate, the very mineral constitution of that world, or rather that succession of worlds—for each stratum is considered as in itself a world—are regarded as having been *altogether different* from the present: for it is not pretended that a single stratum ever has been formed, or can be formed, by any of the operations of nature which are *at present* known, or now going on. Yet from this string of *negations* we are expected to re-

ceive a theory concerning the origin and age of the world, which thus virtually has no basis—which is constructed upon non-entities alone! But we must allow that the theory itself is in character with its evanescent, impalpable foundation, being in itself unintelligible and incomprehensible, and assigning periods which it disclaims all idea of defining or expecting us to comprehend. To evade one creation and one deluge which is revealed, it introduces as many alternate creations and destructions as there are strata, and these are innumerable; and, rejecting the times revealed in Scripture, it sets all time at defiance, or professedly discards it—assigning periods for each single operation which are themselves boundless, and in an infinite series.

Man desires to know these things: he has instinctive longings to comprehend the how and the wherefore of what he sees around him, in the world by which and for which he lives, and the existence of which is so much bound up with his own. God, who implanted these instincts in man, has himself condescended to gratify them. He who alone *could know* the facts, alone *was* before the world began; he has revealed how, at the beginning, the heavens and the earth were made, and how the light was created, and the land was separated from the water; and, lastly, how the living creatures leading up to man, and placed under his domi-

nion, were formed; and God looking down upon man, made in his own image, and upon all the other works of his hands, pronounced the whole to be very good.

And we learn moreover, from revelation, how the sin of man brought evil into that creation, which was at the first very good—how by one man sin entered into the world, and death by sin—how by one man's offence death reigned by one (Rom. v. 12, 17), and how this entailed a curse upon the whole creation, so that God said to Adam, "Cursed is the ground for thy sake; in sorrow shalt thou eat of it all the days of thy life; thorns also and thistles shall it bring forth to thee; and thou shalt eat the herb of the field; in the sweat of thy face shalt thou eat bread, till thou return unto the ground; for out of it thou wast taken: for dust thou art, and unto dust shalt thou return." And when, in the course of time, the sin of man increased as mankind multiplied, and by these aggravated and accumulated sins God was still further provoked, we are taught how, by the hand of the Almighty, an universal deluge was brought up over the whole earth, covering the highest mountains, destroying every living thing from the face of the earth; and how, in order "to keep seed alive upon the face of all the earth," God had forewarned Noah of the coming desolation, and caused an ark of safety to be prepared, that the new world might be provided

with inhabitants without the necessity for another act of creation.

As natural religion leads us to ascribe the origin of all things to God, so it constrains us to ascribe perfection of all kinds and power unlimited to God; and therefore to expect the manifestation of these attributes of God in all the works of his hands: that all things according to their place would indicate the love of God in their provisions for enjoyment, and the foresight and omnipotence of God in the permanency of these enjoyments; securing them alike from contingencies, or from insidious or violent assaults, which might defeat the benevolent intentions of the Creator: but natural religion does not find this to be the case—nay, on the contrary, notwithstanding the admirable mechanism of the creation, and the universal indications of wise intentions, and even of partial and individual enjoyment, it finds that the result is general suffering and premature destruction or decay; each creature living to destroy or become the prey of another; and man, the lord of all, giving, in the abuse of power and disappointment of hope, only too much of semblance to the despondent or misanthropic conclusion of one of the truest of poets and observers, "that man was made to mourn."

Were it not for a *moral* demonstration which was to be given, and a *moral* purpose which was to be accomplished, there can be no doubt that

all the laws of nature would have been fixed and unalterable as those which keep the stars in their courses—impregnable against chance or change. *What* this demonstration is, and how that *moral* purpose shall be accomplished, natural religion cannot say; we must learn it from revelation, and it is at present to be apprehended by faith alone. Yet the Scripture is so full of it, and it is so inseparably connected with every other doctrine of the Bible, that no man can consistently hold any one truth of the Gospel without also holding this truth, which is in fact the gist, and conclusion, and climax of the first announcement of the Gospel, as good tidings of great joy which shall be to all people—it is glory to God in the highest, and on earth peace, good will towards men. The things around us do not render this praise to God at present; and still less do we find proofs of anything of the kind in the strata of the earth, or the facts which geology brings to light concerning the past; but, on the contrary, all seems to be strife and ill will amongst men; and in the bowels of the earth nothing but havoc and confusion seem to have reigned, and these so tremendous as to present no ideas to the mind, save the wrecks of a "Paradise Lost," or the spoils and victims of a once existing pandemonium.

The creation hath fallen from its place through sin; yet not so fallen as to frustrate the purpose of God, or to escape out of his

reach for punishment or recovery. He hath punished, yet not so as utterly to destroy: he will recover, without the necessity of annihilating the old creation and doing another work of the same kind: and God will so restore all things as to show that he hath not been defeated—hath not changed his plan—that he is the Almighty, the first and the last; and that God is Love unalterable—the same yesterday, and to-day, and for ever.

It is a cardinal point of Christian faith that God created all things as one whole, because there was an intention to be accomplished thereby which did not then appear. And it is a cardinal point to maintain, that God will not add to or change the creation; and that no creature can do so, because such interference with the creation would also interfere with the further intention of God. And it is a cardinal point to maintain that this first intention shall be finally accomplished in the restitution of all things, and that by means of the creation which was brought into being for this very end. It is declared that the works were finished from the foundation of the world (Heb. iv. 3)—that all things were made by Christ, and for him (Col. i. 16; Eph. iii. 9)—and that the Son by whom the worlds were made is also appointed heir of all things (Heb. i. 2): and we also, brought into the Church, are made sons of God, and if children then heirs, heirs of God,

joint heirs with Christ, if so be that we suffer with him that we may be also glorified together (Rom. viii. 14). And not only we, but the whole creation, are joint participants in the blessing; for the creation itself also shall be delivered from the bondage of corruption into the glorious liberty of the children of God—all alike waiting for that crisis which is called the adoption, to wit, the redemption of our body (Rom. viii. 23). How these things shall be we profess not to explain; but they are doctrines laid hold of by faith, and they all turn upon the grand personal doctrine of the resurrection of the body, which every Christian cannot but maintain, yet which no one can explain or render intelligible to sense: by the same faith we lay hold of the restitution of all things, and the resurrection of the body, of the first of which God hath spoken by the mouth of all his holy prophets since the world began (Acts iii. 21).

"Through faith we understand that the worlds were framed by the word of God, so that things which are seen were not made of things which do appear. By faith Noah, being warned of God of things not seen as yet, moved with fear, prepared an ark to the saving of his house; by the which he condemned the world, and became heir of the righteousness which is by faith. By faith Abraham sojourned in the land of promise as in a strange country, dwelling in tabernacles

as Isaac and Jacob, the heirs with him of the same promise: for he looked for a city which hath foundations, whose builder and maker is God" (Heb. xi. 3, 10).

Yet this continuity of the purpose of God, and especially this deluge, supernatural, brought about by the hand of God—universal, yet not necessitating a new creation, because certain creatures were kept alive in the ark—this most important of all natural phenomena is wholly excluded from modern geology. That the deluge should not have formed an indispensable part of their system—that it should not have forced geologists to find a place for it in any theory which they might propound—is not creditable to their faith as Christians. But account for it how we may, the deluge has not only been strangely passed by in all cases, but in some cases must have been wilfully resisted; and the facts which testify to it have been blinked, and left unexplained and sunk, rather than honestly admit the only explanation of which they seem capable. The case of the mammoths of Siberia is one of those to which we allude, where animals, confessedly of extinct species, have been found perfectly preserved in the ice, so that the flesh was in a condition fit to be eaten, not only by dogs and bears, but even by men. This fact proves that the deluge which thus destroyed these mammoths was *sudden* and was the *last*, and that races *now*

*extinct* lived up to *that time*. But the remains of similar animals, being found very widely diffused in Germany, in America, North and South, though not in the same preservation as in the frozen regions, prove, notwithstanding that the deposits of Germany, America, &c., are of the *same time*, and that all being destroyed by *the same* final catastrophe, *that* deluge was *universal*. But there can be no universal deluge by *natural* causes, as we have already argued; therefore it was by the hand of God: there has been *no subsequent* catastrophe, or the ice in which these animals were preserved would have been melted; and, the species being *extinct*, infers that there was *no subsequent creation*.

On the other hand, it is asserted by Buffon and other writers on natural history that the camel has never been found wild, but that the whole species, without exception, is in a state of captivity to man. Hence it has been inferred that Noah and his sons retained possession of the camels which had been preserved in the ark, as being the most serviceable of all animals in those regions; and their value is borne witness to by the wealth of all men being estimated in patriarchal times according to the number of camels they possessed. This living species may, therefore, be a witness to the preservation of some animals during an universal deluge, as the frozen mammoths bear witness to the destruction of all other creatures, save those

which were contained in the ark. And an inference of the same kind may be drawn from the fact, that wheat is never found in a wild state, nor can it be determined on any trustworthy evidence from what country it originally came. Yet each country of the ancient world has its own mythology regarding the introduction of the *cerealia*, agreeing so far as to assure us that there is some foundation for it in historic fact, and that wheat has been introduced in all cases—is not indigenous in any.

The deluge of Noah stands alone in Scripture separated and distinguished, by the clearest words that could be employed, from every natural phenomenon, and from everything else that God hath wrought since the foundation of the world; and it is thus particularised not only in the Old Testament but also in the New. God declared before hand that he would destroy the world for its wickedness—nay, declared it one hundred and twenty years before he brought it to pass. During all this time, and while the ark was building, in manifest token of Noah's belief of the coming catastrophe, this preacher of righteousness was warning mankind, and entreating them to flee from the wrath to come; yet they repented not. And after the deluge, lest Noah and his posterity might suppose that this interference with the laws of nature had unsettled all things, and that regularity in the course of the times or the sea-

sons was not to be expected for the future, God himself allayed their fears: he set the bow in the cloud as a token that he would not again destroy the earth by a flood; and he promised that while the earth remaineth, seed-time and harvest, and cold and heat, and summer and winter, and day and night shall not cease. The guarantee shows that there had been such a departure from the laws of nature, that there might be reasonable apprehensions in the minds of men lest such disorder should return. And in like manner St. Peter declares that, as by the word of God, the heavens were of old, and the earth standing out of the water and in the water, by which word the world that then was, being overflowed with water, perished; so the heavens and the earth which are now, by the same word, are kept in store, reserved unto the day of judgment, and perdition of ungodly men (2 Pet. iii. 5-7).

And let it not be thought that declarations like these are mere accommodations to the vulgar notions of unscientific men, like the Israelites, who had been long in the bondage of Egypt, or Galilean fishermen, and men as unlearned and unphilosophic as themselves: let it not be fallaciously supposed that declarations such as these are unworthy of attention in these enlightened times. They are eternal verities. This revelation concerning God, the Creator and Sustainer of all things, is inseparable from

Christianity; and all who are truly Christians cannot but receive these declarations as equally true with the acknowledged fundamentals of our faith. They are as true as Christ is true, and as the inspired penmen of the New Testament are true; for they are over and over again appealed to by our Lord as matters of fact for our instruction, and they are continually referred to by St. Paul and St. Peter, and the other apostles—men filled with the Holy Ghost.

Thus, science and theology concur in obliging us to insist on an universal deluge, as one of the elements necessary to account for the present appearances of things, in consistency with rendering due honour to God as the sole Creator. And we require a place to be found for the deluge of Noah in any system of geology to which our assent may be required: and we reject every system in which such an universal deluge—supernatural, sudden, and final—has not been taken into account. Whether the deluge will *wholly* account for all the appearances, and whether *other* agencies may not *also* be taken into the account, are other questions, depending altogether on other considerations, upon which we would not at present enter, even if we thought that this was the time. But we do not think the time is come—nor is it our province: still less is it our duty, in pointing out the deficiencies of popular systems, to present one to supply their place, though it

might be free from such objections, and should incorporate the deluge and all the other acts of God. We may well decline the task, under the plea that we have not competent information where we find so many, with far more information than we possess, to have failed; and we may also hint our suspicions, if not allowed to express our convictions, that no one has yet attained to a competent degree of information to construct, *at the present* time, such a system as will embrace all the facts, explain all the appearances, and stand the test of time, in a science so modern as geology, embracing so wide a sphere as the whole earth. Our object has been to direct attention to some points which have been mistaken, and to others which have been overlooked or disregarded; but all of which are essential to the right handling and full elucidation of so important a subject as that of "Scriptural Geology."

It is in the discussion of fundamental principles that we have been engaged, according to the observance or neglect of which we apprehend that the science will be placed on a true or a false basis, and all the details will become either valuable or comparatively worthless. We have not, at this stage, entered upon the painful and invidious task of criticizing in detail even the works which we have placed at the commencement of this article, and which we placed there, rather as samples of the better and worse

classes of the writings we had in mind, than with my intention of reviewing them. Dr. Burton's lectures afford a favourable example of the better class of writings on geology; and it would be painful to us, where there is so much that is excellent, to point out the objectionable passages, since it is manifest that the mistakes have arisen solely from reposing too much confidence in those whom almost all look up to as masters and guides in the science of geology. Dr. Burton's piety and orthodoxy are unquestionable; and there is no doubt that his lectures were intended to promote, and do on the whole conduce to, these high and holy ends. Nor are we disposed to question the piety or orthodoxy of men like Drs. Buckland, Pye Smith, and Wiseman; or the many eminent laymen who advocate the geological systems of the day. These theories are held by them without their being conscious of infidelity, and propagated without producing unbelief amongst others, only because they are held inconsistently, and are not carried out to their legitimate conclusion. But such theories are certainly irreconcileable with sound principles of physics—untenable by any who consistently maintain God to be the Creator of all things — and, therefore, are secretly and unconsciously subversive of the Christian faith. Such theories will, therefore, no doubt break down ere long, and the good men we allude to will be among the first to repudiate them.

The other work, to which no name is attached, we only insert because it has gone through three editions in the course of a season; and is, therefore, a proof of the avidity with which men receive bald scepticism in the present day. A more infidel or a more stupid publication has rarely appeared, save that, in point of mere style of writing and manner of stating things, it is in good taste, and shows that the writer belongs to a polished class of society. But it has no claim to attention on the score of reason or augument, and no child that has learnt its catechism would have its faith much endangered by such a work: it is purely and professedly infidel in augument, however modified in phrase: it is inconsistent with even the heathen ideas of a God; and it would only find its parallel in the freaks of imagination which are ascribed to such men as Anaximander and Lucretius—that Nature herself is omnipotent—that the fortuitous concurrence of atoms generated all things—and that matter is eternal.

Such kind of works we, on principle, would decline to meddle with, since the very contact is defiling, and ideas of infidelity and doubt are infused which may weaken the faith and trouble the mind in hours of weakness and melancholy. And such a course of abstaining from the contact with evil we would recommend to our readers, though curiosity may prompt on the

other side. We live in an inquisitive age—in an advancing age; but it is also a superficial and a prolific age: and since, from the multiplicity of publications, some selection must be made by every one, it is worth while to shorten the labour of selection by lopping off at once from our list all those which are of an immoral or an infidel tendency.

# CHAPTER IV.

LECTURES ON THE DELUGE, AND THE WORLD AFTER THE FLOOD. BY THE REV. CHARLES BURTON, LL.D., F.L.S.

THIS volume is a sequel to that which we noticed in our last chapter; and we wish to follow up the observations which were then made with some still more precise and specific on the present occasion.

The time, we think, is come when all friends of religion, and all who are anxious for the advancement of true science, should make a stand, and resist that scepticism which, under the mask or rather the pretence of science, endangers our faith, and that combination of empiricism and dogmatism which threatens the subversion of all right principles of science in geology: the time is come, because scepticism and empiricism have now reached a height which provokes resistance: the time is come, because facts are being brought to light, in the face of which the former position of the geologists will become no longer tenable; and we wish to show that the ground on which they have been standing is rotten to the very foundation—that they may

now abandon it altogether—and not cling to it still, or attempt to repair its breaches, since, sooner or later, the whole structure must fall, and involve those who continue to defend it in the same unhappy catastrophe.

We have not the most remote idea of imputing conscious infidelity to the great majority of those that are misled by the geological theories. And who would think of imputing it even to the founders of those theories? Who would be guilty of such an imputation against Buckland or Sedgwick?—and who would be believed in imputing it to such advocates of those theories as Dr. Wiseman or Dr. Pye Smith? Yet, that the tendency of these theories is towards infidelity we do not in the least doubt; and we believe that it is an inconsistency with the theory, which has been produced and continued by their better feelings, that saves even such men as these from infidelity; and we hope to entitle ourselves to the lasting gratitude of these good men by pointing out the fallacies of the system on the one hand, and the evil consequences on the other, when such a system is followed out consistently; even though we may not be able to supply the place of the system we reject by any other more worthy of science and of Christianity. We are not bound to provide a substitute for every theory which proves erroneous: men can live very well without theory: the time may not be

come for arriving at the truth, and it is incumbent upon us to wait for that which is really true—that which will bear examination and stand every test.

The doubting and questioning spirit which is raised by these theories is not limited to the range of geology, but affects all things; and that not merely by inference, or parity of reasoning, but immediately and directly. For if these doubts are entertained we cannot be sure of a single fact that is past concerning ourselves, or concerning the things around us: all except the mere present we have received from others, or know by revelation and hold in faith, out of which faith we may be shaken if these questions are seriously entertained. For if we can forget the alterations which have taken place in the course of time in horses and dogs, and other domesticated animals—if we look upon the different races of men only as they now appear—those assertions, which we hear from geologists, concerning extinct animals, would, in like manner, apply to the human race, and we might be tempted to deny the possibility of regarding all mankind as one species. The races of men differ as much from each other as do many of the fossil remains from their present living analogues; but shall we, therefore, deny that the Negro, and Calmuc, and Esquimaux, and North American —together with Jews, Greeks, and Romans—are derivable from a single pair? What would

then become of the doctrine of the Fall?—of the death brought in by one?—of the recovery by One?—what of Christianity itself? Or shall we admit that no traces of the deluge are to be found? What, then, becomes of the veracity of Scripture, or of the inspiration of those apostles who spake of it as the parallel of baptism? Yea, what confidence can we repose in the words of Christ himself?—who continually referred to the deluge as a warning to his disciples, and a type of that judgment which should surprise the wicked. And where is the force of the solemn asseveration of Jehovah, that once he had brought that flood upon the earth, and only once, and that never while the earth existed would he bring upon it such a flood again?

Paley works out well the absurdity of ascribing to chance the origin and construction of a watch which a man might find on a moor, since design appears in the watch, and this refers its origin to an intelligent being. In asserting that a pebble which lay beside the watch came there by chance, or had lain there from all eternity, no absurdity appears, unless in the pebble also we see marks of design. He uses the watch but as an illustration of the living mechanism which appears in the bodies of all the animals, and pre-eminently in the body of man, to infer so much the more confidently that the uniformity and perfection of design, pervading all this living machinery, necessitates the

belief in an all-wise, all-powerful Being—that is, necessitates a belief in God. But suppose the main-spring broken—suppose only a wheel of the watch to remain, and suppose the animals to be dead, and that the outward forms alone remain—the argument remains precisely the same; design is manifested in the single wheel, and in the dead animal. And if, in looking more narrowly at the pebble, we find in it well-known marks of some organic form, though it be but the flinty cast of an echinus, it then becomes as absurd to ascribe the origin of this pebble to chance as the living creature of which it retains the form.

To a man who knew what a watch was, the finding of a single wheel would be just as conclusive evidence of design, and as full proof that the thing had its beginning from another, and that one higher than itself, and that it was meant to act upon other bodies for purposes beyond what it alone could manifest, as though the perfect watch had been found where the wheel lay. So the pebble, if it make part of a system, or bear the forms of creatures which once lived and held a place in a system, can no longer be regarded as a kind of random product, to be consigned to the regions of chance, but must be regarded as a witness for order and evidence of intelligent purpose—just as in the instance of a watch-wheel, or the organized being whose form alone has been preserved in the flinty cast.

And turning from the single pebble to those vast mountain masses which swell above the surface of the earth, but are only uprising continuations of the same materials which constitute the valleys and the plains, and in those situations underlie the looser partices of the surface—these all become, just in proportion as we discover in them any order or law, so many evidences of intelligent creation—so many refutations of the doctrine of chance. When *any* plan, *any* order, or *any* signs of past organization appear, it is an impeachment of our consistency and wisdom to find us ascribing such appearances to accident or chance: we may not be able at once to discover THE *plan*, but that there is A *plan* we may rest assured.

A savage, finding the wheel of a watch lying beside a nummulite and a fragment of pyrites, might possibly confound the wheel with a nummulite from the form, or with pyrites from the metallic appearance. It is the prerogative of science to dissipate all such vulgar errors, and to distinguish things that differ. The labourers in our quarries carry home echini and similar fossils as playthings for their children, who call them "fairy loaves:" it is the privilege of the naturalist to assign them their true place in a system. The erection of such buildings as Stonehenge is attributed by the vulgar to a race of giants, because powers are evinced therein which lie beyond and above their capacity of comprehension. But who, even among the

vulgar, ever thought of ascribing such a structure as Stonehenge to a volcano or an earthquake? As reasonably might we assign such an origin to Salisbury Cathedral or Windsor Castle! Stonehenge and the cathedral differ from each other only in our being ignorant of the uses of the former, while the latter is still in use, as belonging to that state of things which at present subsists. The cathedral was built for the system to which we belong: Stonehenge was constructed for another system—this is all the difference. The world was then in other circumstances: Stonehenge was as suitable to what was then required as the cathedral is to what is required now.

The geologists of the present day are, quite unconsciously, taking precisely the same ground in this science which the opponents of Gallileo took in astronomy—namely, setting the vulgar evidence of the senses against the deductions of more accurate and more enlarged observation, and relying upon the appearances of things, as they first present themselves to a superficial observer, instead of patiently waiting until principles can be established which may become universal laws, being based on all the known facts and agreeing with all the recorded phenomena. The opponents of Gallileo said the sun moves round the earth: we see that it does so—all mankind are agreed in this—it is a fact resting on common sense—we must doubt the

evidences of our senses in everything if we doubt it in this: and that this opposition to Gallileo belonged to a more ignorant age does not alter its character; for, if they were ignorant in comparison with the bulk of mankind, so also was Gallileo in comparison with the enlightened *now*—the ignorance belonged to the whole age, and the opposition, in both cases, is to be estimated with reference to the age. "The discrepancy (says one of the modern champions of common sense) is not one with any theory or partial discovery of science which is not yet thoroughly made out, and which future investigations may modify or set aside; but with broad primary facts which involve nothing hypothetical, and which are in reality identified with the first principles of all inductive truth" (*Powell*, 484). But there was a great difference in the motives and object of the two parties—the former retaining a great reverence for the word of God and opposing Gallileo chiefly because his discoveries seemed to impugn and invalidate revealed truths; the latter pluming themselves upon their emancipation from all such superstitious reverence, and taking every opportunity of publishing how entirely they are unshackled thereby, and hoping, by their writings, to render all men as liberal as they are. Both equally mistaken: the discoveries of Gallileo did not—the discoveries of the geologists will not—invalidate the truths of revelation; but only confirm them the more.

The opponents of Gallileo said common sense told them that the sun moved, and that the earth stood still. Gallileo could not transport them to the heavens, where, from some fixed point or from the sun itself, they might observe all the planets in their orderly motions around one common centre: he could only say—"Your hypothesis does not explain motion but by an unlimited and inconceivable draft upon motion, not only for that of the sun, which is scarcely to be followed in thought, but for all the stars, whose distance renders their diurnal motion round the earth utterly incomprehensible." And so the geologists tell us that common sense teaches them that strata are the work of time; yet they cannot explain how, but by drafts upon time, as unlimited and as inconceivable as the draft upon motion in the old Ptolemean system of astronomy: granting the hypothesis that strata are thus formed, each single formation would require countless ages, and this multiplied by the vast number of formations would amount to a sum of years as incomprehensible, and therefore as insane, as the trackless motions of the old astronomy. And, in one respect, the appeal to common sense was more consistent in the case of astronomy than in the case of geology; for the laws of motion were then in operation, and they appealed to what men could not but see and acknowledge to be fact, however they might differ in accounting

for it; but stratification *is not now in operation*; nor is any time given as the basis of calculation: the whole theory and the facts on which it rests are hypothetical; and there is nothing at all analogous going on at the present day, or which has gone on during the present constitution of the earth, and according to the laws by which it is at present governed. What are the *broad primary facts* to which they appeal? The first is that there are no human remains, and the *inductive truth* they draw from this fact is that no strata have been formed since the creation of man. Well, then, either there has been no stratification at all, from the operation having been suspended and ceased; or the stratification has been so little that in six thousand years it has not produced a perceptible amount. In either case present experience gives them no help—they have no fact to appeal to when they are talking so big of broad primary facts. It will not satisfy us to be shown a piece of rock, and to be told that it is obvious that it has been formed in a certain way, unless we are also convinced that such rocks can be formed in such a way by the proof that they have been so formed in the present circumstances of the world, and since the creation of man. In short, we deny the broad primary facts; and just to show how slight are the foundations on which these broad primary facts rest, we would observe that one of the most distinguished geologists

asserted that the depression on certain sandstones were occasioned by drops of rain; and, at a subsequent meeting of the British Association, retracted that opinion, and said that he believed they were occasioned by air bubbles rising to the surface, for he had observed similar marks on the surface of the little heaps of mud scraped up on the sides of the road! Is this one of the broad primary facts?

The truth is that all these are vulgar errors, and will be exploded, and the more rapidly in proportion to the consistency with which they are carried out. They have led to the denial of the deluge, from no sufficient traces being discoverable by common sense: they have led to the denial of the human race proceeding from a single pair on the same principle of common sense; and when they have, by this process, got rid of every old notion concerning creation and providence, we suppose they will begin to think how they can fill up the void: and how this can be done, save by taking God's own account of the matter, and re-establishing, on the basis of faith, the things which they are now discarding in the stolidity of common sense, it is past our comprehension to conceive; but the sooner they begin it the better.

Most of the errors of geologists have arisen from too hasty generalization from single facts—often from mere conjectures or probabilities, which rash men have asserted with a confidence

which has led others to believe that they are not conjectures, but established facts. Stratification, for instance, is assumed to have resulted from the deposition of earthy particles, which it is conjectured were once held in mechanical solution in water of the ordinary temperature, which sediment required a time both to accumulate and harden, the maximum of which may exceed our comprehension, but the minimum of which we may reckon upon; for it must at least occupy as much time as we can estimate it would require to form a single stratum by the operations which are in action on a smaller scale—as at the mouths of large rivers—forming similar deposits in our own time. The question, therefore, is—what is the minimum upon which we may thus reckon? And the answer is, nothing at all—we cannot reckon on a year, or a thousand years, or a million of years, as a demonstrable fact, or as a time during which it has been proved that a single stratum may be formed, or during which an approximation has been made to such kind of formations. The deposits formed at the mouths of rivers and elsewhere are the opposite in all respects of any such processes as the phenomena of stratification require: these deposits are evidence of decomposition, not composition—of breaking down into one homogeneous compound of mud and sand, not of separation between stratum and stratum—of the entire disintegration of the particles which cha-

racterise different formations, which are all broken down, so as to form but one species of slimy deposit in all parts of the earth; which no length of time could possibly harden into stone of any kind, and which, if its hardening were possible, would only form stone of *one kind*, and that a stone only of such earths as are capable of solution in water of ordinary temperature—not of silex, or the insoluble ingredients which form the valuable—that is, the hard and indestructible—properties of the great majority of strata, and of almost all rocks.

One of the vulgar errors of former times was that all things grew—that stones, metals, and coals, were continually forming or enlarging in the bowels of the earth—something like the growth of plants upon its surface, only by a slower process.

The idea that strata are forming, or in process of formation at the present time, is only a relic of this vulgar error; and it is a mere assumption, not only without proof, but without a shadow of foundation. It is a fundamental principle with the geologists that no one stratum has been formed since the world has existed in its present form, and that the last catastrophe which happened previous to this, its present constitution, merely deposited some beds of loose gravel, shingle, and drift—nothing approaching to a stratum—or a solid formation; and that during our present constitution of things there

has been only calcareous formations, such as stalactites in caverns, and incrustations where water charged with lime flows, and similar incrustations of silex around the Geysers; and at the bottom of the sea nothing but mud and coral—on the sea shore only sand or shingle. The question scarcely need be asked, whether any of these have the least resemblance to strata? And such as these are at present they must remain for ever: no time can make any alteration in stalactites or incrustations, so as to change these into crystaline or amorphous rocks, and no time can give solidity to mud, sand, or shingle. Add to which the consideration that each rock formation consists of its own peculiar ingredients, arranged and consolidated in its own peculiar manner, and it will follow that *no one law* can account for the collection of *different* ingredients, from the same common materials of the primitive earth, by *the one agency* of solution in water; nor could the materials, by the mere agency of time, however extended, be consolidated in different degrees: they could not in fact be consolidated at all. Common sense rejects the hypothesis that granite dissolved in water could, by any stretch of ingenuity, be made to furnish the materials for clayslate, red sandstone, and chalk: rejects also the hypothesis that time alone constitutes the difference between clayslate and marl—between quartz rock and sand—between Parian marble

and chalk. And, before the mud of rivers could take any of the varieties of composition to bring into manifestation the distinction of material ingredients in various strata, and before consolidation would avail at all, even if it were at all conceivable, some new arrangement of its ingredients must occur, for producing which we know of no means—at least none are pointed out by geologists. But we deny the possibility of the consolidation of mud by time; and, as it is allowed that no proof of the assertion exists, we cannot be required, without proof, to yield to a mere assertion.

There are geological facts which may, on superficial examination, appear to be evidence of strata being formed by deposition—such as the conglomerate of the old red sandstone, and many more recent formations; and the existence of beds of shingle found between layers of basalt, and also, sometimes, between layers of stratified rocks, may seem to justify the opinion that marine beds may be consolidated. And a still stronger evidence of such a formation of the strata is supposed to be presented by the abundance of fossils, nearly all of which are of marine origin, in many of the strata in all countries which contain rocks of more recent formation than the old red sandstone group. But concerning these facts, we assert that the old red sandstone conglomerate is only such in appearance, not in reality: that it is not made

up of *rolled pebbles*, cemented together by sandstone; but that the quartz nodules and the bed which forms the matrix are of simultaneous origin, and owing to an imperfect species of crystallization. And of the beds of shingles, we assert that they prove nothing more than that such beds existed before the strata between which they are included were formed, but that they rather demonstrate the difference than the similarity—demonstrate that strata were formed in one way, and these beds in another way; since these beds have preserved their own character, notwithstanding they have come within the range and influence of stratification. And of fossils we shall speak separately, and more at large.

First, therefore, concerning conglomerates: there are some which are truly such—that is, which consist of rolled pebbles, or angular fragments, or even gravel of wrinkled and coated flints, cemented together by silex or carbonate of lime into a compact mass, hard enough to form rocks, and capable of being cut and polished. There are also true breccias of volcanic origin, in which various substances, which have been able to resist the heat, or are incapable of fusion, have been cemented together by volcanic glass or obsidian, or some of the species of lava, so as in this way to form a compact mass of heterogeneous materials. But there are also porphyries and amygdaloids of volcanic pro-

duce, which are not to be confounded with breccias; these last being homogeneous formations, although the crystals of the former, and the nodules of the latter, might appear to a superficial observer to have been pre-existent bodies, taken up and imbedded in the mass, and not cotemporaneous formations. And the older porphyries, whose volcanic origin may be questionable, have the same homogeniety of character, the white crystals being only purer feldspar, which is debased by earthy mixture in the matrix, and both are brought into connection by the leucites which are found in volcanic amygdaloids—acknowledged volcanic products —yet assuming the form of regular crystals. Now, there are *blocks* of conglomerate proper, scattered about in various parts, and they sometimes form masses of rock of great size; but we have never met with, or heard of, a *stratum* consisting of conglomerate—that is of rolled or angular fragments of older rocks cemented together by a stone of more recent formation, which is the kind of stratum meant by conglomerate, properly so called.

" There is a fact which may be made intelligible to an uninstructed person, or even to a child. In those stratified rocks which are of a sandy constitution, it is common to find *pebbles*, from the size of coriander seeds to that of birds' eggs, and much larger. These bear demonstrative evidence of having been derived from more

ancient rocks, by fracture and detachment, long rolling on a hard bottom under water, dispersed through the loose sand of a deposit, subsiding to the lower part if a tolerably free motion were permitted, and then consolidated. To this portion of a sandy formation, whose parts are thus agglutinated, the appropriate term 'conglomerate' is given."

The millstone grit of Herefordshire is given as one of the best examples of this; it being the old red sandstone which lies under the mountain lime, which forms the lowest member of the independent coal formation, and with which sandstone the Silurian formation of Murchison may be regarded as commencing. The uninstructed person is pointed to "the extent of this formation, and its depth, often many hundred, and sometimes two or three thousand feet.....then let him attempt to follow out the processes which the clearest evidence of our senses shows to take place, and let him be reluctant and sceptical to the utmost that he can, he cannot avoid the impression that ages innumerable must have rolled over the world in the making of this single formation" (*Burton*, I. *Appendix*, 1-13).

This is the stronghold of the geologists, and their only stronghold; for it is the only formation of this kind—the only formation which has the appearance of consisting of rolled fragments imbedded in sand, and consolidated into

the hardness of rock. If this be ever so correct an account of the formation of *this rock*, we cannot extend the laws or principles which its mode of formation suggests beyond rocks which are indisputably *similar* in their structure; but there are none such, and it is unphilosophical to argue from an example which is unique, and which *distinguishes* old red sandstone from other rocks, that other rocks have been formed in the same manner. The want of pebbles and sand in other rocks is an argument that they have not been formed in the same manner as old red sandstone; for they want the only evidence on which reliance is placed to prove that sandstone has the origin asserted. The clayslate which lies below the Silurian formation contains no pebbles or sand: the mountain lime which lies above it contains no pebbles or sand; and these three contiguous formations are so diverse, that it is impossible to ascribe to all of them the same origin.

But suppose it should turn out that the sandstone itself does not consist of pebbles and sand? Suppose that the uninstructed person, and even the child, had been deceived by appearances? Suppose that it may prove no true conglomerate? And what will become of the argument then? Now we assert most confidently, on evidence collected forty years ago, and strengthened each succeeding year, derived also from the very localities which are referred to, that

the opinion formed by most persons on a superficial view of this great formation—viz., that it is owing to the detritus of older rocks, held in mechanical solution, and deposited in a course of time, the length of which is to be estimated by the quantity of the matter—is a vulgar error. And we further assert, that, though our knowledge of this formation is, we believe, as extensive as that of any living geologist, we have never yet seen a conglomerate in Herefordshire formed of loose pebbles dispersed through the loose sand of a deposit, as it is defined in the extract which is given above.

Our attention was turned to this subject very early, by its being popularly held in that neighbourhood that stones were actually forming upon the mountains at that very time; and that rocks might be found in every stage of growth, from loose pebbles and sand without any adhesion, through the soft marly strata, up to the highest degree of hardness in the silicious millstone grit. This led to an examination both of the ingredients of the Silurian strata, and of the mode in which consolidation had taken place, and we found that the assertions made must be reversed; for the loose pebbles and sand were nowhere the materials of future rocks undergoing the process of consolidation; but were either the disintegration of former rocks undergoing the progress of decomposition, or materials which had not been brought into circumstances

under which they ever would or could become consolidated. And on a careful examination of the ingredients, it was found, the formation considered as a whole, must be regarded as silex, as the formation below it is clay, the formation above it is lime; and the admixture of other earths must be regarded as accidental debasements, not as permanent characteristics. The pebbles, as they are called, are not fragments of older rocks, rolled by the action of water, whether on the sea shore or in the bed of a river: they are all nodules of quartz, never having had any other form than this vitreous half-rounded half-angular form — more like lumps of fat in a pudding than anything else— and the colour only varying in the degree that known specimens of quartz rock vary from each other. These nodules are all of one kind—they are all quartz—they all emit the same peculiar light and peculiar smell when struck against each other, and the common people call them all by the one name of "jack-stones," as having one and the same appearance and character. Besides, these nodules differ not essentially from the granular bedding, or sand, as it is called, by which they are consolidated: all are the same debased silex, though the nodules are less debased, especially by ferrugineous and ochreous mixtures, than the bed. And it should be particularly remarked, that the consolidation is not effected by some third substance of the nature

of a cement being superadded to the pebbles and sand as they are called, to bind them together as one mass; but the consolidation is accomplished by that semi-crystallizing process by which the particles of oolite or Portland stone are bound together—a law by which it is obvious that the larger nodules and the smaller grains have both been regulated, since the same cleavage which is found in the mass is found in both directions in every nodule and particle of which the mass consists, which could not be the case if these nodules were pebbles, and fragments of other rocks, with every possible variety of cleavage. Besides the rock in question is one of the most durable of any, bearing exposure to the weather for centuries, as in the case of Buckstone, without the least decay; retaining the chisel marks quite fresh in many of the old baronial castles; and, as its name of mill-stone grit imports, it is used for the huge troughs and grinding stones of cyder mills, which proves its homogeniety; for were there any other ingredient less durable than silex, the acid of the cider would speedily act upon it, and the stones would fall to pieces in a few years. Perhaps a still more conclusive proof of the durability and homogeniety of this rock is afforded in the British Museum by two colossal heads, from Upper Egypt, wrought out of this very rock—the old red sandstone. They are thus described in the volume of "Egyptian

Antiquities," published under the superintendence of the Society for the Diffusion of Useful Knowledge. "There are two colossal heads in the Museum which are entirely detached from any other part of the body: they are numbered 43 and 57 (since numbered 4 and 6). No. 43 (4), like the other, is of a brown breccia, highly crystallized. The right side of the face is peeled off (this is a mistake: it is an accidental injury); and the large coarse component parts of the stone are thus distinctly shown. One could hardly imagine it to be susceptible of so fine a polish as we still observe on the entire parts" (Vol. i. p. 287).

There is another consideration of a more abstract kind, but which, when followed out, refutes still more conclusively this idea of the sandstone being a conglomerate, because it demonstrates that such a thing is *impossible;* and we entreat our readers to give particular attention to this view of the question. Observe, the sandstone is allowed on all hands to be a very extensive formation, and geologists have more ground for maintaining that it is universal than they have for the universality of any other formation, though their system necessarily supposes that all have been universal in order to secure sequence, and that one only shall be forming at a time, and not several contemporaneous formations in different parts of the earth. But the sandstone bed we speak of is everywhere

the same—everywhere pebbles and sand—and therefore an *universal* conglomerate of rounded stones from older rocks. Now mark the consequence: rounded pebbles can only be formed by water in motion, and that likewise shallow water, or water beating against a shore. In still water no pebbles can be formed; in deep water they will not—and still less on dry land. The sea shore—the shallow river—and the gurgling rill, are the places where pebbles are formed: of one or all these agencies the geologist may make choice to provide materials for this mighty accumulation of pebbles, two or three thousand feet in thickness, and extending over the whole earth. But no other agency than these three will we allow him—none other can accomplish the work. Is the earth, then, to be *all* gurgling rills, or *all* shallow rivers, or *all* sea shore, to form these pebbles? How can they get on with the work of formation under the necessary conditions of water, everywhere shallow, and everywhere in motion, yet accumulating such vast quantities of these supposed pebbles? The whole supposition is self-contradictory, and therefore impossible: it could never even begin, and therefore millions of years could not accomplish it. And though it is said that these pebbles are fragments of older rocks, we know of no rocks in the least like them. No clayslate, which is the next older rock, is at all like them—no gneiss or granite is like them:

nor, although of quartz, are they at all like the quartz pebbles of mountain torrents, or of the Chesil bank, and similar beaches: for these supposed pebbles, when examined closely, are found to have the vitreous and compact surface of crystallized bodies, and not the scratched and worn surface of rounded bodies; and often there are veins and wrinkles on the surface which as surely prove the unimpaired condition of the stone as does the bloom remaining fresh on the peach or the plum. The rock being mainly silex, this silex coagulates into nodules of quartz, the size of which depends upon the greater preponderance of silex over the foreign mixtures of ochre and clay, while these last are bound together by the silex which is diffused through the whole mixture. Just as in that granite, which is mainly feldspar, the feldspar coagulates into pseudo crystals, yet the rock is chiefly bound together by the diffused silex; or, as in porphyry, which is almost entirely feldspar, the purer feldspar runs into white crystals, which lie scattered through a mass of the same feldspar, but coloured and debased by the foreign ingredients of the rock, whether red, green, or grey. The whole mass, pebbles as well as bed, has the same cleavage, showing that all have been consolidated under one law. The very instance, therefore, chosen as the strongest proof of the geological theory completely fails—fails on examining the rock, which turns out to be

no conglomerate—no agglutination of pebbles; and fails on the ground of its being an universal formation, in which case such an origin as has been supposed would be impossible; for pebbles can only be formed under circumstances which are necessarily local and partial, and cannot be universal. An universal formation of pebbles supposes shallow water running over all the land in a constant current everywhere to form pebbles on the land, and for the marine pebbles a beach against which the sea is continually beating. It requires, in short, an earth everywhere streamed over with running water; and it requires a sea which has no ocean depths, but is everywhere a surf beating against the shore.

It has been only by keeping to generalities and avoiding entering into particulars that the geological theory has been able to keep its ground so long; and we have to expose just the same kind of vulgar error touching the *ingredients* of the sandstone formation as that which we have just disposed of touching its mechánical origin and structure, with the time supposed to accumulate its materials, and the further time supposed to be required for the consolidation of them after they have been accumulated. And we first take their own account of the ingredients to get rid of it; as we shall afterwards have to show that there are other ingredients such as they cannot account for in this manner, and which, if taken into con-

sideration, must necessarily change the whole tenor of the argument, and force them to give some more sufficient account, or else to acknowledge their ignorance.

"Frequently the lower portions, sometimes dispersed heaps, and sometimes the entire formation, consist of vast masses of conglomerate, the pebbles being composed of quartz, granite, or some others of the earliest kinds; and thus showing the previous rocks, from whose destruction they have been composed" (*Appendix*, i. 13). Concerning the conglomerate referred to, and which forms the entire bulk of the old red sandstone, this is not the case: its nodules are all substantially and essentially of one kind —all silex—and that of nearly as much purity as the Cairngorum crystals, and only debased by the colouring matter, which takes different shades of red and green. The simple and familiar test of this is, that they give phosphoric light when rubbed together, accompanied by the peculiar smell which quartz gives out, and none of them stick to the tongue, or yield the smell of clay when breathed on.

The pebbles, as we have already said, though of quartz, are not similar in substance to quartz rock—they are, in fact, *sui generis*. And supposing they had been of granite or of the older formations, how did it happen that clayslate has none of these pebbles, though clayslate lies between the granite and the sandstone? And

how did it happen that there are no pebbles consisting of clayslate in the sandstone, and no clay in any assignable, any recognizeable proportion, from the supposed destruction of clayslate? Are we to conclude that the granite pebbles overleaped the clayslate on the one hand, and that the power which was sufficient to destroy the granite was insufficient for the destruction of clayslate on the other? How are we to account for the presence of granite, and the absence of intermediate clayslate? But the whole notion is absurd. The sandstone, which has silex for its characteristic ingredient, stands between a formation of clay and a formation of lime. It is supposed to be derived from clay, though its chief ingredient is not clay but silex; and it is supposed to furnish the materials for mountain limestone, though it has scarcely anything save silex: and neither sandstone nor clayslate contain any quantity worth mentioning of lime. It would be far more consistent and intelligible to revive some such theory as that of the alchymists concerning the transmutation of metals, and say boldly that clayslate is transmuted into silicious sandstone, and that mountain limestone is a further transmutation of the sandstone and clayslate. If there be anything fixed in nature it is this—that these three substances consist of dissimilar and essentially different ingredients, which are not interchangeable; but ever have been, ever will be, in all

respects, distinct. Moreover, in considering the mode by which this great group of sandstone acquired its present bulk and place among the various formations, we have to consider the animal remains which are found in it, as well as its mineral ingredients; for no one will pretend that these animal remains were washed out of the granites and older rocks—these at least are co-existent with the formation of the sandstone, and not pre-existent creations. It was for a long time denied by geologists that there were any animal remains in the old red sandstone, in defiance of the testimony of all practical men; and when these produced specimens, they were met with the assertion that it could not be from the *old* sandstone—it must be from the *new;* or there must be some mistake. Hugh Miller decided this point, not only by the number of perfect specimens which he had collected in his long-continued labours in the quarry, but by being able to take the sceptics to the very beds where similar specimens are still to be found, and confront the boldest theory with a still bolder, a still more obstinate fact. Murchison and Sedgwick have followed up the discoveries of Miller in Scotland by extending them to the whole formation, not only in Wales and Devonshire but on the continent, especially the steppes of Southern Russia, where the old red sandstone spreads out to a vast extent, and in beds which appear to be for the most part

quite horizontal. This formation is substantially the same wheresoever it is met with—that is, its place among other formations, and its mineralogical character as silicious sandstone, are the same; though its place may sometimes appear doubtful in certain localities, from the absence of clayslate below, or of lime above; and though its character may appear different in various hand specimens, or even in various beds, from superabundance or absence of some particular members of the formation, or irregularity in those characteristics which do appear; the formation, as a whole, is marked as distinctly as granite, both in the place it occupies and in its characteristic ingredients: and it does not present greater anomalies, nor greater diversities, than do the granites. We have only to remember buildings of granite, or the Egyptian monuments of our museums, or the very pavement of our streets, to understand the varieties in granite to which we allude; and sometimes the difference is very striking in the same block of granite, as in one of the colossal heads in the British Museum, which, though of one stone, is divided in appearance into two formations by a sharp transition, so that a hand specimen of the one and a hand specimen of the other would be thought to have come from different quarries: and such differences are found in the sandstone sometimes in the working of the same quarry; always in comparing

the sandstones of different localities. It is found in the single block of Buckstone.

The second chapter in Hugh Miller begins thus:—

"'The old red sandstone (says a Scotch geologist) has been hitherto considered as remarkably barren in fossils.' The remark is expressive of a pretty general opinion among geologists of even the present time, and I quote it on this account. Only a few years have gone by since men of no low standing in the science disputed the very existence of this formation—system rather; for it contains at least three distinct formations; and but for the influence of one accomplished geologist, the celebrated author of the 'Silurian System,' it would have been probably degraded from its place in the scale altogether. 'You must inevitably give up the old red sandstone (said an ingenious foreigner to Sir R. Murchison, when on a visit to England about four years ago, and whose celebrity among his own countrymen rested chiefly on his researches in the more ancient formations)—you must inevitably give up the old red sandstone: it is a mere local deposit—a doubtful accumulation huddled up in a corner, and has no representative abroad.' 'I would willingly give it up if nature would (was the reply); but it assuredly exists, and I cannot.' In a recently published tabular exhibition of the geological scale by a continental geologist, I could not distinguish

the system at all. There are some of our British geologists, too, who regard it as a sort of debateable tract, entitled to no independent status. Even the better informed geologists, who assign it its proper place as an independent formation, furnished with its own organisms, contrive to say all they know regarding it in a very few paragraphs. Lyell, in the first edition of his admirable elementary work, published only two years ago, devotes more than thirty pages to his description of the coal measures, and but two and a half to his notice of the old red sandstone."

Yet this sandstone, which crops out beneath the coal measures of South Wales, and rests upon the Silurian rocks, is estimated by Sir R. Murchison to be no less than ten thousand feet thick in that region (*Lyell*, 452).

The sandstone is divided into three groups or deposits in Herefordshire—first, immediately below the coal measures and lime, a quartzose conglomerate, passing downwards into chocolate red, and green, sandstone and marl—this is Pye Smith's pebbles and sand; second, cornstone and marl (red and green argillaceous spotted marls, with irregular courses of impure concretionary limestone, provincially called cornstone, mottled, red, and green: remains of fishes); third, tilestone (finely laminated hard reddish or green micaceous or quartzose sandstones, which split into tiles: remains of molusca

and fishes); beneath which lie the Silurian rocks, and then the clayslate. The sandstone of Scotland consists, also, of three principal masses—first, red and mottled marls, cornstone, and sandstone; second, conglomerate often of vast thickness; third, tilestones and paving stone, highly micaceous, and containing a slight admixture of carbonate of lime. In the uppermost of these divisions, but chiefly in the lowest, the remains of fish have been found: so that the conglomerate which is uppermost in Wales occupies the middle place in Scotland; but, in both instances, it is in the other beds, and not in the conglomerate, that the marine remains are found. Dr. Smith has chosen this conglomerate as the most striking, most irresistible evidence that strata are formed at the bottom of the sea by the consolidation of pebbles and sand, the heavier subsiding to the bottom. But it is unfortunate for his argument that no marine productions should be found in this selected instance, and should be found below it in Wales, and both above and below in Scotland; and it is equally unfortunate that these pebbles, which ought to have been at the bottom, are at the top in Wales, and in the middle in Scotland—especially as it has not been occasioned by any superior hardness or compactness in the other strata, for the conglomerate is among the most firm and well characterized of stones: and the two other groups are much

varied in character, but generally soft and friable—always comparatively in reference to the other. We think that it would puzzle Dr. Smith to answer an uninstructed person, or a child, who should ask for an explanation of this.

We have spoken of the cleavage of the conglomerate, as passing through both the nodules and the bed, and proving that the composition of both is the same, and showing that the rock is not strictly a conglomerate, but of homogeneous structure, although the quartz has coagulated into nodules, and given it the appearance of a conglomerate. This cleavage is a very important characteristic, and will ultimately lead to a more accurate conception than is yet attained of the structure of rocks, and of the mode of deposition. All rocks have a cleavage, but only cleave with facility and regularity when fresh from the quarry, or live rocks, as the quarrymen call them. The cleavage depends upon the earth which is most abundant, and therefore we are speaking of rocks which have a mineralogical character—not of those which are so debased or heterogeneous as to have none, and not of course of volcanic products. The cleavage of rocks is in two directions, nearly at right angles, and nearly perpendicular to the line of stratification, so as to allow the rock to be broken easily into cubes, more or less perfect, according as the cleavage is at a right angle or not so. Every one knows the

difference between cleavage and crystallization in calcareous spar; and there is the same difference between cleavage and stratification in rocks: whatever be the difference in the form of the crystal in carbonate of lime, it always cleaves into rhomboids of the same angular shape, and so rocks which have a cleavage retain it uniformly unaffected by the different degrees of inclination in their stratification. Cleavage and stratification must, therefore, be kept distinct in our minds, and more especially in the slaty rocks, some of which derive their slaty character from cleavage, like all the clayslates; others deriving it from stratification, as all the tilestones—the plane of the clayslates being almost perpendicular to the horizon, while the plane of the tilestones is nearly horizontal. And as Professor Ansted says, it is necessary to notice certain appearances in the structure of stratified rocks, which require for their explanation the action of some other force than that of gravity, and which may rank among the most difficult, though at the same time the most interesting problems at present under consideration in geology.

Roofing slate, when examined in a quarry, and on a large scale, is found not to be stratified in the usual sense of the word; but to be affected by three kinds of stratification, in different directions, and independent of one another. Of these three kinds one corresponds with ordi-

nary bedding; and its direction may sometimes be traced by the remains of shells or other organized bodies which, however, are frequently absent, and the true bedding very obscure. Another kind is called, by geologists, cleavage, and is the cause of the great facility there is of splitting the slate; while the third kind scarcely resembles stratification at all, but consists of a tendency in the rock to separate into solids, of definite shape and proportions—the places at which this tendency shows itself being called joints or divisional planes (i. 38). And it is observed that these joints are found not only in slate, but in the mountain limestone of Derbyshire and of Ireland, and that they cross each other nearly at right angles, and everywhere bearing nearly NNW. SSE. for one set of joints; and N.S. for the other, or nearly at right angles with each other and with the beds. Professor Ansted also remarks that these joints form lines of separation, often slightly open, and passing not merely through strata but through various semi-crystalline aggregations, evidently formed since the original accumulation of the strata (39). Wherefore evidently since?—only because they are determined to regard these semi-crystalline aggregations as water-worn pebbles from pre-existent rocks—only because, blinded by the theory of mechanical deposition of the strata, they cannot see what impartial persons see, and are conclusions

and consequences of their *theory*, not consequences of authentic facts.

No one, we suppose, would maintain that carbonate of lime was first formed into the crystals of calcareous spar, and afterwards polarized to produce its cleavage into rhomboids; and equally absurd is it to maintain that rocks are stratified first, and afterwards polarized to produce their cleavage. As in the act of crystallization, that arrangement of particles which gives cleavage to crystals takes place—so in the act of stratification, that arrangement of particles takes place which gives to such rocks as we speak of the kind of cleavage which belongs to them; and which shows that these rocks or strata are not merely and entirely mechanical deposits, but are truly semi-crystalline aggregations, formed under certain laws of chemical affinity. A section of the Penrhyn slate quarry is given by Professor Ansted (ii. 196), on which he observes—"The slate here alternates with a coarse sandstone, not parallel to the beds (that is to say, that though the sandstone is enclosed between parallel layers of slate, the layers of the sandstone run obliquely across the interval between the slate beds, and not in the same direction), and in one part the sandstone is exhibited on both sides of an anticlinical axis. Throughout the whole, however, the cleavage has the same direction, clearly proving that this last change

(viz., cleavage) has taken place not only since the consolidation of the whole rock, but also since some very considerable disturbances have altered the direction of the beds." Other sections are given of the slates of the Towey, which extend over "a rugged country, more than thirty miles in length, and eight or ten in breadth. The whole region is made up of contorted strata, and of the true bedding there is not the shadow of a doubt. But the coarser beds and the finer, the twisted and the strait, have all been subjected to one change, and crystalline forces have re-arranged whole mountain masses of them, producing a beautiful crystalline cleavage, passing alike through all the strata." And again, through all this region, whatever be the contortions of the rocks, the planes of cleavage pass on generally without deviation, running in parallel lines from one end to the other, and inclining at a great angle to a point only a few degrees west of magnetic north. "They appear to me (says Professor Sedgwick) only resolvable on the supposition that crystalline or polar forces acted on the whole mass simultaneously in given directions, and with adequate power" (199). And a similar section is given of highly contorted slate rocks, with the same parallel cleavage, from the cliffs near Ilfracombe, of the Devonian formation.

The beds of the clayslate are rugged and distorted, even in a greater degree than the beds

of the sandstone and newer stratified rocks; but the cleavage in clayslate and the stratified rocks is not at all affected by these distortions—the cleavage remains mathematically true to the same point of the compass and the same high angle with the horizon, uniformly very nearly perpendicular, and very nearly north and south, east and west. It is confessedly very nearly uniform; and we are persuaded that it would be quite uniform if the observations were all checked and harmonized by trigonometrical bearings: for it is impossible to place absolute reliance on local observations, from the disturbances occasioned both to the compass and to the plummet or spirit level in mountainous districts. Roy and Mudge, in the trigonometrical survey of Scotland and Wales, found that the attraction of a mountain sometimes diverted the plummet as much as 7° or 9° from the perpendicular, and of course affected the spirit level to the same amount; and Professor Forbes on the Riffelberg peak found a variation of near 60° in the compass, owing to local attraction. "At first I thought Kater's compass pointed wrong; the sun, which was near setting, appeared due north! Then I took another compass, and got the same result. It was clear that there was an enormous local attraction of the hill on the needle" (314).

True slaty structure is not in the plane of stratification, but in the plane of cleavage—does

not approximate to horizontal lines, but approximates to perpendicular lines. Tilestones in the quarry lie flat; slates in the quarry stand on their edges. As Professor Sedgwick observes, "It would be well to describe no structure as *slaty*, except cases of transverse cleavage; using the term slate for a perfect oblique cleavage, and some such term as *flagstone slate* for imperfect cleavage: and in like manner *slaty flagstone* may describe a very thin or laminated structure parallel to the stratification" (*Ansted* ii. 201). We have thus to bear in mind that there are two kinds of structure to be accounted for—the slaty or perpendicular, as well as the stratified or horizontal. The slaty structure is studied to most advantage in clayslate, where it is forced upon the attention of every accurate observer, yet even here its importance has not been sufficiently considered; the universal application of the principles which are derivable from the study of cleavage, on which the slaty structure depends, has not been sufficiently borne in mind. Hauy, when investigating the nature of all crystals, found it requisite to make their several cleavages one of the elements for determining their characteristic differences, and he found that, although the same substance crystallized in many different forms, yet all these forms had the same cleavage: and that, though the laws of crystallization were very complicated—and it was often difficult to trace crystals to their true

primitive form—yet the law of the cleavage in each substance was but one, and all crystals of the same substance, however various in shape, had the same constant cleavage. Thus, though there are more than two hundred varieties of regularly formed crystals of calcareous spar, and irregular crystals without number, all these crystals, when broken, present the same cleavage, in three directions, and resolve the particles of any crystal whatever of carbonate of lime into rhomboids, having the same angles of obliquity. Moreover, we often find thick-shelled echini in the great chalk deposit in which the shell has lost its own animal structure, though retaining its exact animal form, with all the minute apertures and tubercles upon the surface. These thick shells when broken are found to consist in general of calcareous spar, and when this is the case the spar has its proper cleavage, as rigidly exact as in the most perfect crystals: and, what is still more to the purpose, retains perfect parallelism in the three planes of cleavage all round the shell, so that the lines of cleavage form every angle possible with the surface of the shell, these remaining parallel all round the circle, and therefore being sometimes radii, and passing into more and more obliquity till they become tangents. In some of the most instructive of these echini, the shell has been crushed, while the fleshy part of the animal has retained its coherence and elasticity, shown in parts of the shell

being pressed outwards by the flesh being squeezed, and other fragments of the shell being forced into the body of the animal by the violence; in both cases the broken shell remains, a fragment of calcareous spar, surrounded on all sides by flint; yet all the fragments and all the unbroken portions of the shell have the same cleavage, not only regarding each fragment separately, but regarding them altogether—the cleavage in all the separate parts has the same conformable planes—the direction of these, in any one fragment, being the direction which all the other fragments will be found to have.

Now, taking all these facts together, we think it is impossible to avoid the conclusion that cleavage and crystallization are connected, and that cleavage is a more constant and more simple characteristic than external form; and that it is also more enduring, as it remains when there is no other appearance of crystallization, and when the external form would lead us to expect the internal structure of the shell of an echinus, not the cleavage of calcareous spar. And that this is a real crystallization we have proof in some of the rarer specimens, one of which now lies before us, in which the greater portion of the shell retains the usual surface of the furrows and tubercles of the echinus; but a portion of it is become hexangular prisms with triangular summits of transparent spar, agreeing in cleavage with the rest of the shell, and dif-

fering only in more perfect crystallization. This, too, is a crushed specimen, and the small detached fragments have the same planes of cleavage, proving most conclusively the three points—first, that cleavage results from a constant law of structure; secondly, that this law is the basis of crystallization, and continues in semi-crystalline substances; and thirdly, that time is not a necessary element, since it has here taken place before the flesh of the animal had lost its cohesiveness and elasticity; and that there is no appearance of infiltration—the stone being a compact mass of black flint. Substitute the term stratification for crystallization, and we then shall find the law of cleavage, which prevails on a small scale in crystals and echini, operating on a large and grand scale, but with equal distinctiveness and regularity, in mountains of clayslate, and may, by tracing it there, detect its operations in the old red sandstone and other coarse stratified rocks, where it has been at work as constantly in arranging their masses also, although this source of information has been hitherto very little regarded by geologists. In "Ansted's Geology," ii. 199, a section of the slates of Ilfracombe is given, the beds of which are contorted to such a degree that some of them are raised to an angle much sharper than the ridge of a house, and then sweep down again to form the segment of a circle, presenting on a large scale as much deviation from a straight line as the

spherical or crushed echini present on a small scale: but, notwithstanding all this irregularity in the stratification, the cleavage remains parallel throughout, being everywhere nearly in the direction of the points of the compass, and everywhere inclining about ten degrees in the same direction from the perpendicular. If stratification be regarded as only a mechanical deposit, this uniformity of cleavage, notwithstanding the want of conformity among the beds, is an insuperable difficulty; and it must necessarily force every unprejudiced mind to give up the theory of mechanical deposition as utterly untenable on this single ground, if there were no other; but, unfortunately, the theory of stratification has taken a hold so strong on the minds of many that the theory must be upheld in defiance of facts, and an absurd explanation of the facts must be attempted rather than abandon the theory, when the facts can be no longer passed over, or can be no longer denied. The facts we have adverted to are indisputable: it is certain that the beds of clayslate have been very much contorted, and yet that the cleavage is perfectly regular and quite undisturbed; but it would overturn the theory of stratification to admit that the beds were deposited in any other than horizontal positions: therefore, it is pretended that the stratification was first horizontal, and that, after being thus consolidated, they were contorted by earthquakes and other convulsions, and that, when finally settled in

their present position, the laws of cleavage were superinduced by electric, or magnetic, or some other hypothetical and unknown agency. What empiricism is this?—and that in a science which professes to rest exclusively on observation and matter of fact! Any one looking at clayslate must feel assured that the law which has given to its particles a *slaty* structure is a law of its constitution; and much more those who visit a slate quarry will feel assured that the law which has made them *slates* is the primal, the fundamental law.

It is an axiom in physics, and ought to be regarded as a fundamental principle in all sound philosophy, that the constant law should regulate and control that which is inconstant—that the general principle should form the basis of our reasonings, and deviations from it should be regarded as anomalies and exceptions. In calcareous spar and all transparent or vitreous bodies we are constrained to regard crystallization and cleavage as original constitutions of the bodies, and therefore as simultaneous, because any subsequent change in the disposition of the particles of a crystal would both destroy its form and would take away its hardness and transparency. But the same applies to semi-crystalline substances like clayslate—to all substances which have such a structure as indicates an arrangement of their particles according to laws peculiar to those several substances, and

not like gravitation, or mechanical deposition, common to all substances. And the more to bind clayslate by the same laws as crystalline bodies, there are many instances of alternating beds of clayslate and compact porphyry running through the whole mountain like solid tye-courses, and binding the whole together as one entire mass: yet, in these cases, each course of slate has the same cleavage and in the same parallel as all the other courses, though divided from each other by a compact mass of porphyry. It is impossible, we think, to account for this by any subsequent action: the cleavage must be the original structure of slate. Such cases as these can only be at all explained by the advocates of the mechanical theory abandoning strict principle, and regarding the porphyry as in these instances *stratified*, though in all other instances regarded as *volcanic*, and regarding the clayslate as metamorphic, which means neither one thing nor the other.

"Porphyry is very rarely stratified," says Professor Ansted; and he adds in a note—"Among the most remarkable exceptions to this may be mentioned the alternating masses of slate and porphyry which are found in the lake district of Cumberland and Westmoreland, rising into the highest and most rugged mountains of the whole region. These two distinct classes of rock are piled upon one another in tabular masses of such regularity, and are so interlaced and

blended, that we are compelled to regard them as the effects of two distinct causes acting simultaneously during a long geological period. The igneous portions present almost every variety of felstone (compact felspar) and felstone porphyry, sometimes passing into greenstone, and rarely into masses with a structure like that of basalt" (ii. 183).

The quotation is from Professor Sedgwick. But surely it would be far more creditable to admit at once that they know nothing about such deposits as this, or candidly to allow that here their theory fails, than attempt to persuade men that two *distinct* causes—that is, elements as *opposed* to each other as fire and water—have been "acting simultaneously during a long geological period" to produce effects which neither fire nor water will account for. We cannot conceive the meaning of introducing the element of *time* into such a question, for the question is one of collision between the opposite theories of fire and water, and time cannot change the properties of the one or the other of these—cannot make fire cease to produce its proper effects—cannot change the contrary attributes of water. Moreover, it is from supposed traces of these effects yet remaining that the former presence of these "two distinct causes" is inferred, fire having produced "the igneous portions"—that is, the porphyry beds—water having produced the intervening beds.

of clayslate, "two distinct classes of rock, piled upon one another in tabular masses," yet "effects of two distinct causes acting simultaneously." How simultaneously? Let us call the slate A, formed by water as a distinct cause, and call the porphyry B, formed by another distinct cause: the effects are, first, A depositing a bed of slate; secondly, B depositing a bed of porphyry; thirdly, A depositing another bed of slate; fourthly, B depositing another bed of porphyry, and so on. This alternation is succession—there is nothing simultaneous in it.

The bedding of the clayslate is determined, both in the case of its contortion, and in the case of alternating with porphyry, by the fossils in both cases lying between these joints, and not between the joints of cleavage—between the joints which approach the horizontal, not the perpendicular line. But the particles of the clayslate are arranged in the substance of the slate according to the cleavage, and not according to the bedding; and the cleavage and the component particles are regular and in straight parallel *laminæ*, however much the beds may be contorted, and though divided from each other by beds of porphyry. It seems impossible to account for this on any other supposition than that the structure which occasions the cleavage, and which is nearly at right angles with the bedding, is a semi-crystalline structure, and that it must have taken place simulta-

neously throughout the whole mass, after the beds had been thus disturbedly and contortedly deposited, but before any of them had become consolidated, and while the particles of all the beds were free to take that uniform semi-crystalline arrangement which makes all the slates cleave in straight parallel lines, notwithstanding the contortions of the beds, and notwithstanding the intervention of the porphyry. The conditions are so far from requiring "a long geological period" that they absolutely forbid it: the arrangement of all the particles in all the beds is so uniform as to assure us that it has taken place at the same time in all the beds, and that it has no connection whatever with either fire or water—is not to be accounted for by either theory, by horizontal mechanical deposition and subsequent volcanic disturbances—nor by the strange mixture of both, which is broached concerning metamorphic rocks, and would persuade us that, after the particles have been consolidated in one way, they may, by long application of heat, undergo rearrangement in another way, without fusion—without changing their outward appearance. Fusion cannot have taken place here, nor even any considerable degree of heat though far short of fusion; for it is allowed that any considerable degree of heat would destroy the fossils, and alter the structure of the mass; but it is said, that a gentle heat during a long geological period may effect

changes which neither intense nor gentle heat can effect in a short period; and, as this is said without any analogy or proof, we feel quite at liberty to reject such an assertion, however respectable the persons who make it.

And touching the contortions of the beds, which generally are conformable with each other, through the many beds which form one mountain mass, we entertain not the least doubt that the beds have in no case been consolidated singly and separately; but that the whole mass of each formation has been placed in the situation that it occupies in a very short space of time—that the whole mass was of the consistence of plastic clay, however numerous the beds might be, and that the whole formation was simultaneously hardened—not by the injection of any foreign cement to bind it together, but by a semi-crytallization of its own particles, similar to that process by which plaster of Paris sets, and mortar hardens. The contortions, it should be remarked, are of two kinds: the contortion proceeding from the inequality of surface upon which the beds have been cast and lodged, and which leaves the beds conformable with each other, and each bed homogeneous in its own structure; and those contortions of structure found in the bed or mass itself, and which pervade its substance, and that sometimes without affecting its relationship to the other beds—the walls of the

bed being conformable, while the internal arrangement of the particles has been very confused. Violent agitation has been frequently going on in the mass itself without affecting other adjoining strata; and often it has affected them so far as to produce an interchange of portions of their contents, and yet the stratification has ultimately seemed as regular as if nothing had happened. There are even instances of fishes broken into two parts by a violent convulsion, the head remaining in one stratum, the tail in another adjoining stratum, clearly showing the simultaneous consolidation of the three strata: of that containing the head, that containing the tail, and the intervening stratum.

There is no formation in which there are such frequent and indisputable marks of agitation, during the time of formation, as the sandstones, from the old red sandstone, which is as hard as granite, to the Hastings and green sand beds, which are always soft and friable, and sometimes only loose sand. The rocks themselves and the layers of sand show marks of most violent agitation; like cross currents alternately prevailing, or like waves dashed together, and doubling each other over by the stroke.

It is a vulgar error to suppose that fire and water, either separately or combined, could produce the appearances which stare us in the face upon the most superficial examination of the

strata of the earth. And if we are asked, what then has produced them?—we are not ashamed to confess that we cannot tell—we are not ashamed to refer these, as all other things, to the almighty power and superintending providence of God. And this not merely as a pious sentiment, but with a plain practical meaning, and as willing to maintain it consistently, and follow it into all its consequences. We have shown, on a former occasion, that the existence of *any* dry land is a miracle—is supernatural—is contrary to what would be the case if land and water were left to themselves; as all the land would naturally, as the heavier of the two, take its natural place beneath all the water. And as the existence of dry land is beyond the course of nature, so the ordering of the various strata of which that land consists is not according to the course of nature—not according to the specific gravity of the ingredients; nor are the sources evident, scarcely can we say they are assignable, from whence the ingredients which form these several strata could be derived.

It is loosely said that the ingredients have been furnished from the decomposition of older rocks; but when this comes to be examined it is either palpably false, or means just nothing at all. It is palpably false if the older rocks contain no such ingredients—it means nothing if no such ingredients are derivable from these

sources in any periods of time which we can reckon. A cypher standing alone has no more real value than a nonentity. Men must really shut their eyes, and resolve to hear no reason, before they could so speak of the constitution of rocks, and so interpret the various fixed phenomena. Geologists are in the habit of speaking slightingly of mineralogy, which may proceed from a lurking suspicion that mineralogy is too rigidly exact for their loose system, and furnishes tests which nothing but sterling genuine truth will endure. Mineralogy teaches us that each rock has its own character, derived from the ingredients which are peculiar to it; and we further know that these ingredients characterize all the rocks of the same class, whether hand specimens or quarries—whether single mountains or ranges which constitute formations large enough to fill a continent. Thus granite is known everywhere by its three ingredients, and every rock which contains these in this semi-cyrstalline form is a granite: and if either ingredient be wanting, or other ingredients be added, the rock is called by some other name. It is conceded on all hands that the lowest rock we know of, the rock upon which all other formations rest, the only source for those who derive secondary rocks from primary, is granite—granite proper—consisting of quartz, mica, and feldspar: this is the great fundamental storehouse from whence alone the materials

for constructing the geological system can be derived. The granites in general resist decomposition entirely: no apparent decomposition has taken place in the granite obelisks, which are the oldest existing works of man: none appears to have taken place in other exposed masses which are probably of higher antiquity than they. Therefore it is difficult to believe that any sufficient quantity of material could be derived from granite, under ordinary circumstances of exposure, which are always presupposed. Then, granting that granite may be decomposed in sufficient *quantity*, what would be the *quality* of the substance it yields? This question we can answer, for some granites do decompose, and the substance they yield is employed for making china—being the kaolin of the Chinese, and the porcelain clay of Dartmoor. Grounding our assertion on all the experience we have, we assert that granite decomposes only into porcelain clay, and that porcelain clay it must ever remain under present circumstances—that no length of time would produce any other change—least of all its consolidation into gneiss or clayslate; and the supposition of its transmutation into all the other rocks is too absurd to be entertained for a moment. Let them make what use they can of the ingredients of porcelain clay; but let them not attempt to deduce from it those rocks which consist almost entirely of ingredients which are not to be found in porcelain

clay. All the errors have arisen from allowing men to shift their ground; and, having begun with granite, to finish with some totally different material—such as sandstone or chalk, or beds of gravel and sand, entirely composed of silex and iron.

The mineral ingredients of the different formations and their fossils or organic remains are found together, and must follow the same law. If the fossils infer order and succession, the same order and succession apply to their mineral ingredients. If next to the old red sandstone fossils, the fossils of the mountain lime succeed, then next to the ingredients of the old red sandstone succeed the ingredients of the mountain limestone. But how, by any stretch of fancy, old red sandstone can be decomposed into mountain limestone, it passes the limits of our comprehension to conceive! It is a plain, palpable, physical impossibility. We might take at random almost any two adjoining formations in proof of the same kind of impossibility—such as the firestone, gault, and green sand below the chalk, or the Bagshot sand, London clay, and Kensington gravel above it; no one of which can reasonably be supposed to have derived its ingredients from the formation which precedes it, or to have furnished ingredients for the formation which succeeds it. Yet we are gravely told that these formations afford in their bulk some means of determining the amount of time which would be required to de-

compose green sand into chalk of far greater bulk than itself, and to resolve the superfluous chalk, which has disappeared after leaving this goodly residuum, into, first, the Bagshot sand; secondly, the London clay; thirdly, the Kensington gravel: each a distinct formation, each most unlike chalk, but all coming, at first, second, and third hand, from the chalk, as the chalk, through innumerable hands, from the fountain of all—the granite, which is about as like to chalk or London clay as the moon is like green cheese. We broadly assert that there is no resemblance between the several formations, which can warrant the idea that the newer have derived their ingredients from the older; and that it would be scarcely more absurd to maintain that calcareous spar, and fluor, and selenite, are derived from rock crystal, than it is to maintain that sandstone, and chalk, and London clay, are derived from granite: but if this position of derivation from granite is untenable, the whole theory, so far as time is concerned, falls at once. The only basis on which the calculation of time rests is this—how long will it be ere granite is decomposed in sufficient quantities to form these enormous, these various strata?—and how long would it require to reconsolidate them into slate, or sandstone, or marble? We say—never. We say the process supposed could never even begin, because the supposition involves an impossibility. Other sources than the granite must be found; for

the granite is no source at all: other agencies must be resorted to than those at present at work, since these have never produced the shadow of an approach to such results. The geologists have wholly failed in solving the problem; some other, some abler hand, must take it up, and none but a believer in revelation can take it up with any hope of success. The most important elements—those on which the true solution depends—lie beyond our present experience, beyond the region of sense, and belong to revelation, and are articles of faith, not mere matter of fact. Looking at the mere facts, the geologist cannot account for them; they are beyond his reach—they are supernatural—and so they would be if their living analogues at present existed on the earth. It is not their belonging to extinct species that raises the difficulty: it is from the strata themselves —their ingredients, and the positions in which they are found—the difficulty arises. This is the point to grapple with, and we must fairly grapple with, and not evade it, to be crowned with success.

And we must find a solution which will apply to all the points involved, and not merely to one of the points in question. The deluge of Noah is a point in question, and it differs from the question concerning stratification in two most important particulars—it is so circumstantially described in Scripture that, if received at all, it must be understood literally—and it is so en-

grafted on the traditions of all mankind, that, if we reject it, no tradition is of value.

Dr. Burton feels that he cannot go the length of the geologists in this: he cannot reject such unequivocal declarations of Scripture—such universal tradition as this; and, being admitted on these grounds, it follows, of course, that he believes it to have been universal, covering the tops of the highest mountains, and miraculous, brought about by the immediate operation of God. All this Dr. Burton allows concerning the deluge of Noah; but, with singular inconsistency, holds with the geologists, that the deluges by which strata were formed might be brought about by natural causes, although they say that these deluges were so vastly more impressive as to have left imperishable memorials in the strata which they formed; whereas they say that the deluge of Noah has left no memorial. We say *none*—and pin them to this; for it forms the basis of their whole system: they say that *no remains* of man are to be found among the strata, and that therefore these strata were formed before the creation of man.

What is this but saying that natural causes are sufficient to account for all that we behold of a vast, and grand, and magnificent description in the world?—but we will give to God the credit of one act which is reported to have taken place, yet which was comparatively insignificant, and has left behind it no memorial!

# CHAPTER V.

1. Physical Description of New South Wales and Van Diemen's Land; Illustrated by a Geological Map, Sections, and Diagrams, and Figures of the Organic Remains: by P. E. De Strzelecki. 2. Lyell's Journal of a Geologist in North America.

The difference between empiricism and science is this, that the empiric depends solely on his facts, as he calls them—depends on his own limited experience, his own partial deductions; while the man of science endeavours to avail himself of all the experience and all the knowledge which is to be found amongst all mankind: and, in proportion as the science we take in hand is more extensive in its sphere than the subjects to which we have been accustomed to give attention, so is it necessary to enlarge our views before we dare assume that we understand it; much more before we can lay down any fixed principles by which we may venture to test—by which we may venture to regulate and classify the single and isolated facts which may break in upon us from time to time, starting

up in the remote regions of these extensive sciences.

In a science like geology, which is wide as the circumference of the world, deep as the solid foundations of the earth, the experience of a whole nation, yea, of a whole generation of scientific men, may be too limited to afford sufficient grounds for laying down any fixed principles—any universal law; and, if so, the attempt to lay them down is dogmatising at the best, and may be mere empiricism. In so extensive a science, there may be provincial—there may be national empiricism; for the empiric is not necessarily an individual: it may be a whole society of one type. No one at present hesitates in allowing that the old Wernerians formed one class of empirics, and that the Huttonians or Plutonists formed another class: and the time may come when another and larger class may be formed through an amalgamation of the former two.

Werner did much towards making us better acquainted with the external characters of minerals: Hutton and Playfair brought to light many curious effects of heat on mineral substances, coinciding very remarkably with the appearances of various classes of rocks, in the formation of which the agency of heat had not been till then suspected. But the mines of Germany were too narrow a basis for an universal system: the gunbarrels and pigmy fur-

naces of Hutton and Sir James Hall formed ridiculous caricatures in comparison with nature's grand laboratory, however valuable the single facts may have been which were established by their interesting experiments; like, as it cannot be denied, that many important facts were discovered by those diligent experimenters, the alchymists, in the middle ages. We apprehend that the system of geology, which is at present in vogue, rests on too narrow a basis to be permanent; for Germany and Great Britain are the only countries in which mining operations have been carried on to such an extent as to render it possible to know truly the constitution and superposition of mineral masses. Nor shall we have any confidence in the assertions which are made concerning the structure of the earth, until the results of mining operations in many distant parts of the earth have been made known; and that by men of science who have themselves collected the facts, and who can tell us wherein these facts agree with, or differ from, the facts which have come under our own observation.

It is only by mining and quarrying that the relative positions of strata can be ascertained in the habitable parts of the earth: for the bare cliffs and precipices of mountainous districts usually consist of one kind of rock only, and scarcely ever teach more than what is the prevalent rock of the district. A traveller,

passing through a country, may readily discover its general features—its superficial character; but such observations are of no value in geology. The surface of the earth has been so much disturbed, and by such a variety of agencies, that we can draw very few inferences, from what appears above ground, concerning the rocks which lie beneath. And even the rocks which break through the soil are not always those which form the substratum of the district: anomalies, like the semigranitic peaks of Malvern, or like the different masses of the Wrekin and the Skirrid, occur in all countries, by which a passing traveller would be misled. It is only in the bowels of the earth that the true positions of the several formations can be ascertained: and it is only by many observations, and in distant countries, that we can ascertain whether these relative positions are merely local, or whether they are so general as to be justly considered universal—that is, universal, when not interfered with by some local irregularity—some exception to the general law.

We surely are not now needing to be taught that no system of geology can be deduced from hand specimens, or the contents of the best cabinets: these do no more than give practical tact, accuracy in perceiving minute distinctions, separating species, and distinguishing varieties from each other. In like manner, the partial and exaggerated views which are taken by those

who are conversant only with a single district, or with one country, become so many impediments in the way of forming a general system—that is, a system which shall hold true in all cases alike. The rocks themselves, and their relations to each other, must be studied *in situ*, and on a large scale, and in many localities, before any general system, having any pretension to truth, can be formed; and since it is now well known that in different quarters of the globe these formations differ greatly in relative position, in quantity, and in character, they must be thus carefully studied, in all parts of the world, before we can be sure that any one system, even as a local system, is true, and will stand every test; for the general *does* test, *does* govern, the particular system, though the local and particular may fall far short of, and little conduce to, any general system.

Much mistake arose when the new science of geology came into notice, through the partial views of nearly all the founders of it—of all who were thought eminent, and gave *éclat* to the geological theories. Their opinions were formed upon facts derived from their own several localities, and they not unnaturally supposed the condition of things to be similar throughout all the earth. Werner, confident in the facts of German mineralogy, devised the aqueous theory of formation; and he founded a school of most enterprising young men, who brought to light

daily new facts, all of which they held to be corroborative of the theory of their master. To them they were so, because, having their minds pre-occupied with one idea, all the facts which they saw told in the same scale, and they saw no other facts. Their facts were all deduced from one region, under the domain of one power, to whose agency the theory had been, in the first instance, very carefully adapted. The followers of Werner were many of them blind in their devotions; some knew no other facts than Werner's; and when they did look out for facts in this or other lands, beyond the German pale, it was with German eyes: they caught at all the facts which were favourable—saw none which were unfavourable to the aqueous theory.

Hutton and Playfair, on the other hand, from having made the basalts and whins of Scotland their peculiar study, were led to regard fire as the chief formative agent in all rocks; in which they were strengthened by the very striking experiments of Sir James Hall, who found that by exposing pulverised rocks to heat, under such pressure as would prevent the gases from escaping, they would become consolidated; and not only rocks but saw dust, or vegetable matter, thus treated, could be converted into coal: and he also found that substances which were converted into glass by cooling *rapidly*, might, by *gradual cooling*, be made to assume an opake and stoney character, instead of the shining

vitreous character. Thus, for consolidating the earths into rocks, fire appeared to be a sufficient agent; while, at the same time, it was shown that heat, combined with pressure, would neither calcine nor vitrify, but only consolidate.

Both parties, however, left unaccounted for the notorious and all-important phenomenon, that vast masses of strata are *conformable* with each other, yet not *homogeneous*; a fact which renders both these theories, under any modification, equally inadmissible: for supposing a stratum of hard silicious sandstone to lie between two strata of clay, yet all three perfectly conformable, which is a very common case, this state of things cannot be accounted for by either hypothesis; water will not account for it because the ingredients differ; fire will not account for it because the clay is not consolidated; and any pressure which enabled the fire to consolidate the rock would consolidate the clay also, which lies in juxta-position on both sides of the rock.

The English geologists, who have since taken the lead, and chiefly in consequence of the formation of a Geological Society in London, began without any theory, and on the sole principle of collecting and classifying facts; yet, from the remarkable abundance of fossils in the London clay and gravel, and other deposits lying above the chalk, they have been led to the study of animal remains, and have given fossils a very prominent place in determining the distinctions

between different deposits, and the order in which they have succeeded each other. Had they kept to this, their proper province, all would have been well; and we should have been able to use their local knowledge of fossils in full confidence, without abatement, without qualification: but, unfortunately, they, too, have been ensnared by theories which we do not wish to speak of harshly, and which we would not allude to at all, but that they do warp observation and distort facts; while, in prematurely grasping at too much, they are in danger of losing all.

All these errors are gendered by that partiality which arises from limited observation; and the corrective will come in proportion as other facts from distant quarters are made known: for even, if all the facts in all cases should be tinged with partiality, yet if they be from *distant* regions it will be *different* kinds of partiality, and the errors will neutralise or compensate each other, leaving a residuum of truth; and, therefore, we welcome any observations concerning the geology of distant countries, and the more so in proportion as they are more detailed: therefore, we are glad to meet with the works which we have placed at the commencement of this paper, and especially the first of them, which is a very striking account of a most remarkable country, and a country with which we are only just beginning to become acquainted. It is by an extension to all parts

of the world of such observations as have been made in England that truth will be established; and until this is done we cannot be expected to receive, as universal principles or foundations on which geology as a science may securely rest, facts derived from one country alone, and that also a country, the geological structure of which is notoriously different from all other countries, in the number and variety of the mineral products found within the same extent of space, and in the singular abundance of the most useful minerals—coal, iron, and lime—which are found throughout the whole length of the land from Bristol to Newcastle, and which have already formed a larger ingredient in the prosperity of England than any other of her internal resources, yet seem destined to exert an influence still greater on the coming age, and to carry her forward in a career at once so rapid and extensive as to cast all our past experience into the shade—to make England one city—and that the metropolis of the world.

England presents a remarkably good field for geological observation, from its great variety of rocks all abutting against its western mountains, and exposed along its southern coast, where their succession and junction is traceable along the cliffs which are laid bare by the action of the waves. The granites of Cornwall form a base against which the mica slates and shales of Devonshire lean, succeeded by the limestone

of Plymouth, and the marles and lias of Lyme Regis. To this succeeds the oolite of Dorset, passing into Portland stone and Purbeck, surmounted by chalk, London clay, and the fresh-water formations of the Isle of Wight. This complete succession is a great advantage, in simplifying our ideas at the commencement of a study; but it is accompanied with the temptation of making our systems of geology exclusively English, from assuming that we have on our southern shores a complete display of the whole succession of strata, from the fundamental granite to the last sands and gravels which lie over the Norfolk crag or London clay. We think that, as no formation is universal which is not to be found or accounted for everywhere, when the formations above and below it appear, so every universal formation, or its equivalent, should appear in such a succession as this; unless we can account for its absence by marks of denudation or disruption, leaving a manifest *hiatus*, which we are then at liberty to supply from other lands.

But in finding equivalents, or in supplying a deficiency, we are in danger of unwarrantably increasing the number of universal formations; and of making an aggregate of many particulars, which has real existence nowhere. We cannot allow that the universal formations are more in number than the distinct formations which are exposed in every such situation as the southern

coast of England: and if it be asserted that another formation ought to be present, we require distinct proof, from more than one other series, that this formation is accidentally absent from the English series; and every such proof of accidental absence generates the suspicion, on the other hand, that some may be accidentally present which ought not to be regarded as universal formations.

In the last geological map of England, Sir R. Murchison regards the distinct formations as eighteen; but of these only twelve appear on the southern coast. These twelve, therefore, are all that should *à priori* be regarded as universal, and the absent six may be regarded either as local deposits, or as having equivalents and substitutes in some of the twelve. We find, in fact, that two of the absent formations are the upper and lower Silurian, which have indisputably their equivalents in the old red sandstone of Devonshire; and the other four, which are absent, belong to the coal measures, which we have always regarded as local deposits, or, when regarded as a whole, would call it the *independent* coal formation: believing each coal district to be distinct and separate from all other formations, and having no right whatever to a place among universal deposits, or to rank as one of a geological series.

Every universal deposit, having a place in a series, must re-appear whenever the strata which

lie over it are removed; as the Hastings sand re-appears at the Isle of Wight, and at Purbeck, under the green sand and the chalk. But if the carboniferous strata were universal, they ought to appear in the neighbourhood of Torbay, between the old red sandstone and the new; but nothing at all like them appears, except a few patches of Babicombe and Devon marble. By the same rule, if strictly applied, we might strike out the lias, and the Oxford clay, from the series of universal deposits, since they are decidedly local and partial; though not so entirely separated into patches as the independent coal formations—and of course the London clay, and the other less considerable deposits above the chalk, which are only accidental lodgements in the superficial hollows, and have so little solidity or constancy of character—have still smaller pretensions to be ranked among formations, or as forming members of a geological series. These being struck out would leave only eight distinct formations above the granite—mica slate, old red sandstone, new red sandstone, oolite, Portland stone, Hastings sand, green sand, and chalk; and it would greatly simplify our ideas to regard all other strata as only appendages or subdivisions of these.

Clay slate is regarded by Sir R. Murchison as only an appendage of the old red sandstone, and chlorite as an appendage of mica slate. This principle might be extended; and, in studying

foreign geology, we must be prepared to find rocks which, though differing from our own, it will be safer to regard as equivalents for, or subdivisions of, formations with which we are already acquainted, than to constitute new formations, which convey no new ideas, but are little more than the same thing under a new name.

The most remarkable of the recent additions to our knowledge of extensive formations is that which has resulted from Sir R. Murchison's examination of the old red sandstone of Cumberland, and Wales, and Devon, and South Russia; yet all these can only be regarded as subdivisions of one great formation, for some of the members prevail in one locality, some in another; and the other members are reciprocally defective and seen only in the minutest indications, if not totally wanting. But looked at in reference to the primary and secondary rocks, these all, as one whole, occupy precisely the same place in the system which had been long ago assigned to our old acquaintance; it is, after all, only an old friend under two or three new names: and though we quite agree with Linneus in thinking that it requires more science to distinguish species than to form genera, and so give all credit to Sir R. Murchison for his sagacity, we would also urge the propriety of respecting well established genera, both because classification and order are stamped upon all that we see, and,

because life is too short to be wasted in learning a new classification for every new discovery.

For it is to be borne in mind that, as things at present stand, one classification is as good as another, provided it be equally clear. All present arrangements are merely optional and conventional—are not scientific—are merely like the sorting of papers in an office, or the arrangement of words in a dictionary, for more convenient reference. The principles upon which a scientific arrangement should be made are not yet discovered.

One of the most able and candid of geologists, Professor Amsted, in his "Introduction to Geology" (p. 93), observes:—

"It is, perhaps, an unfortunate circumstance for geology, that in whatever way the subject is first viewed, it is surrounded with difficulties, from the impossibility of actually connecting geological phenomena with the operations now going on around us. If, for instance, we endeavour to trace back the history of the world, and pass from the consideration of the alluvial matter carried down by rivers to that of the gravel, which appears to be the newest deposit, and one abundantly spread over various formations, we are at once struck by the utter inadequacy of any cause now in action to produce such effects. If, on the other hand, we attempt to look back to that far distant period when the world was only beginning to assume its present form, it

requires no slight effort to dispossess the mind of a certain incredulity, naturally arising from those feelings of astonishment produced by the contemplation of phenomena so unfamiliar to us, and apparently so inexplicable; and a great effort is required fully to comprehend them. Before, however, entering on the considerations of the Palæozoic rocks, this effort must be made; for in them we have a series of strata, whose total thickness amounts to many thousand feet, which contain, in rich abundance, several distinct groups of animal and vegetable remains, not one of them the same, and but few of them similar to the animals and vegetables of our own time; and these deposits are spread over a large proportion of the actual land upon the earth: the species found in them, in England, being again met with in Russia, in North America, and apparently in Australia."

Professor Ansted does not use words at random; and, speaking of the *impossibility* of connecting geological phenomena with any known operations of nature, he means what he says. There is an impassable gulph between our world and the world of geology, which renders an explanation of the causes of the geological phenomena a present *impossibility*; and, where data are wholly wanting, *time* will not lessen the difficulty—millions of years will not remove an impossibility—will not accomplish a work which has never begun: the element of time in such a case is wholly beside the question—is

altogether absurd; and as we are unable to take the very first step—as we are unable to connect the alluvial matter carried down by rivers with the newest geological deposit, that of the gravel, which has some little resemblance to present operations—how greatly does the difficulty increase as we recede more and more from the only world we know, and its present laws!—and we need not wonder at finding the laws of that other, that Palœozoic world in which not one of the creatures was the same as those of our own time, appearing wholly inexplicable. The Palœozoic world is separated from our own by an impassable gulph: its laws are at present unknown to us, and so far as these laws are concerned our only wise conduct is to be silent. But concerning its phenomena, we do well to observe and classify them, just as we might observe the phenomena of Jupiter or Saturn; and when all the phenomena have been collected and compared, it may lead to general inferences tending to clear away the present difficulties, and perhaps to bridge over that gulph which now separates us from the past; and, in the meantime, we may beneficially avail ourselves of such systems of classification as are at present in use, so far as they can be made to apply to the past world, using them only for present convenience, and being ready to give them up when necessary, or when any true principles shall be established.

It is true, as Professor Ansted says, that the

subject is surrounded with difficulties, and that there appears to be an *impossibility* in surmounting them; but the impossibility arises from the inadequacy of the causes which have been referred to by geologists: it may be impossible by these means to account for any one of the phenomena which we observe. Yet there may be other causes and other means, which have not been noticed, or have not been brought to bear upon the question, which may afford such explanations of geological phenomena as to remove the difficulties, and bring them into harmony with the present system of things, and its acknowledged laws and operations; and in preparation for this it is absolutely necessary to get rid of the idea that the modern theories will stand. No length of time will suffice to cause that which is absurd in principle to cease to be absurd: though it is by their enormous drafts upon time that men bewilder themselves, and forget the first absurdity. No alluvial deposit will suffice to account for, or could possibly produce, such a deposit as the gravel, the uppermost and least considerable of the geological strata; and scarcely amounting to a stratum, seeing it is not consolidated into rock, but is only a loose bed. But if so—if there is an impassable gulph between the present alluvium and the first and least considerable of the strata—if there be an "*impossibility*" in actually connecting these two—how does beginning at

the other end of the geological series help the enquirer? How is it less impossible to connect the *oldest* of the strata with the present alluvium? How are the difficulties lessened by pointing to the farthest removed, the most enormous and widely diffused formations, which, from their great hardness, as stones, are most unlike of all to the mud of rivers? The difficulties *increase* instead of diminishing at every step, and are rendered still more palpably and appallingly insurmountable by the *fossil contents* of the older strata; of which we are told that "not one of them is *the same*, and but few of them *similar*, to the animals and vegetables of our own time." We want to be taught how the *first* step is to be taken, from the operations *now* going on to the gravel beds; but we are told that there is an impossibility in the way of this. Yet we are carried at one vast bound to the *far distant* Palæozoic, and so bewildered by the new and strange sights presented to our view, that it is hoped we may forget to enquire how we came there, and receive with blind confidence any account of the matter that our guide may furnish.

If words have any meaning, no length of time can render an impossibility possible; but we are not laying hold merely of words—the words assert a truth, and it is for that truth we contend. No length of time can convert the mud of rivers into gravel strata, because they are things totally different in substance; and no length of

time can further change gravel beds into solid rocks, or newer strata into older, because the ingredients are so different. And the totally different living beings which are entombed in these older stata only interpose another and a still greater difficulty in the way of accounting for what we see, by operations now going on around us. Time was out of the question, and beside the mark, when it lay only between mud and the gravel beds: but in the fossils of the old strata another constitution of things is also introduced—therefore, our time and its laws are superseded, and cannot by any possibility come in. It is not only gratuitous but absurd, in such a connection, to speak of "that far distant period when the world was only first beginning to assume its present form;" when we are told in the next breath that "not one of the creatures was the same, and but few of them similar to the animals and vegetables that now exist." It was not, in any exact sense, *this world*, when the laws of matter were different, and all living things were totally unlike to ours.

It being, therefore, an acknowledged fact that the operations now going on around us cannot account for the least and lowest of the geological phenomena, let us hold fast to this fact throughout the whole system of geology. Let us be consistent, and not cheat ourselves into the idea that, as the discrepancies become greater, it becomes easier to account for the phenomena.

The existence and continuity of the same properties and laws are assumed and taken for granted as the basis of all reasoning, without which basis not a word of argument will stand, and we should be left to mere speculation and chance. But these properties and laws being the same, it is absurd to suppose that a connection, which cannot be established *now*, might have been established millions of years ago: or that a present *impossibility* may, perchance, have once been possible, or may yet become possible in the long lapse of ages whose duration is incomprehensible. It is here that the error slips in. Time, as mere succession—time, in the indefinite sense of past, present, and future—mixes with all our thoughts—with our thoughts of the things we see, whether connected with present operations or not. But time becomes definite—becomes the scale to measure other time only when we can connect it with present operations; yet even then only so in the same sense in which it is definite—that is, only to measure the things which are under present laws, and can be connected with operations now going on. Time, as a merely indefinite period, and in the vague sense of boundless duration, has no place in science: it belongs to the wonderment of the vulgar: to have a place in science, time must be connected with some known epoch, during which some known process has been accomplished. But the processes now

going on cannot be connected at all with geological phenomena—therefore, no time defined by these operations can be applied to geology: geological time consists of vague, incomprehensible, boundless epochs, which no one attempts to define. But the mind having been beguiled into contemplations which bewilder it as to time, may become bewildered in other respects; and may deem it allowable to assume that things which are incomprehensible now—nay, in which we acknowledge a present impossibility—may have taken place somehow or somewhere during those inconceivably remote epochs; forgetting the ground and basis of all the argument, which is, that the things have *not* changed their properties, *and, therefore,* we may account for them. If, from what we know of alluvium, we are unable to account for the gravel beds, no drafts upon time will enable us to account for them: and still less from the same alluvium, which is our only *datum*, to account for the Palœozoic formations. And since it is an acknowledged impossibility to connect the gravel with any operations now going on around us, we are surprised that men do not perceive that the impossibility is increased an hundredfold by every stage between the gravel and old red sandstone: and we wonder at the inconsistency of first acknowledging a difficulty to be insuperable and then overleaping it, and speaking of far

greater difficulties as though they were easy of explanation.

The radical mistake consists in regarding rocks that are stratified as *mere deposits;* and that, in defiance of all experience, which testifies that no mere deposit ever hardens into stone. By deposits we mean any kind of sediment which falls to the bottom of water in which it has been *mechanically* suspended—meaning to exclude those substances which may be held in *chemical* solution, and are thrown down by electric or chemical agency, or evaporation of the solvent fluid. And there will be found this marked distinction between mere deposits and chemical precipitations—that the former will dry in amorphous cakes, or loose friable powder, void of internal structure, having no arrangement of particles, no law of cleavage; but the chemical precipitations will be of a crystalline nature—perfectly so if the solution and precipitation have been complete, and varying only according to the nature of the substance and menstruum—always the same if made under similar circumstances. Thus we call all kinds of mud, and sand, and shingle, mere deposits; but the stalactites formed in caverns are not mere deposits, because the lime has been dissolved in water, and not mechanically suspended, and the stalactites are semi-crystalline bodies. And the difference is still more apparent in

plaster of Paris and all kinds of mortar, which require that the ingredients should be in a chemical condition, and that the water should be in proper quantity when, at its setting or crystallization, the water suddenly disappears, not by evaporation, but by being taken up as water of crystallization at the moment when the consolidation of the mass takes place.

We must keep in mind the difference between mechanical suspension in water and true solutions, and remember that disintegration is the very opposite of consolidation, instead of being a step towards formation. Men may pound rock crystal, or the diamond itself, and shake up these powders in water; yet the deposit will not crystallize or consolidate. To form crystals of such substances, a perfect solvent for them must first be found. And that which applies in the fullest sense to the hardest and purest substances applies to all substances in a lower sense, and according to their several degrees of purity. A solution of copper may be precipitated in a solid form, so as to be a perfect revival of the metal, with all its former properties; but mere filings of copper, shaken up in water, cannot be made to yield such results. In like manner the disintegration of granite and the older rocks, by exposure, and frost, and storms, would not at all prepare for their being reconsolidated into strata: some solvent power is necessary beyond the mechanical suspension,

in water. Disintegration is in itself simply destructive, and it is the same in all cases. What would be thought of the man who should find the trunk of a tree decayed by exposure and mouldering into dust, and should yet maintain that, if buried for some thousands of years, it would reconsolidate, and become sound timber? Scarcely more absurd would this be than the maintaining that the deposits of rivers may in time consolidate into stone. The fibrous structure of the tree upon which its character as wood depends, and which constitutes also its solidity, is not an accidental arrangement of particles indurated by time, but is the nature of the tree, and the same in all the trees of the same species. And, *mutatis mutandis*, exactly such is the case with rocks. Rocks have not grown, but they have been *formed*, and different laws of formation are observable in different rocks, manifested in different internal arrangement of their particles, like the various kinds of fibre in trees. And as each species of tree shows the same fibre in every tree of the same species, so each kind of rock has its own internal structure, which is found to be the same in all instances of rocks of that species. And by these internal characters a specimen may be known at a glance, as readily as oak is distinguished from beech by its grain. And the internal characters go beyond mere difference of grain: there are differences of fracture, lustre, opacity—as well

as of smell, touch, and weight—or cleavage, effervescence with acids, and changes wrought under the action of the blowpipe.

All these various characteristics of the different rocks will be found more decidedly marked as the rocks approach to a crystalline structure, in consequence of the preponderance of one kind of earth, and that in a state of greater purity: and the rocks will even assume the precise form of true crystals without transparency—without losing the earthy character of rocks, and only greatly enlarged in proportions, by the addition of the earthy ingredients. A specimen of corundum now lies before us, to all appearance a mere stone, yet it has precisely the external form of an enlarged sapphire—an irregular six-sided prism crossed by deep furrows, terminated at each end by a six-sided pyramid with smooth faces. Coarse garnets, and zircons also, are often found debased while they are enlarged, and retain as rocks those forms which belong to their proper earths when found in the pure state of crystals. We call all rocks semi-crystalline formations on these grounds of fracture, cleavage, and other signs of internal structure, in which they agree with pseudo-crystals in all respects, and with true crystals so far as the pure ingredients preponderate over the earthy; and we thus regard all of them without exception, because these characteristics of formation, as distinguished from amorphous sediment or chance medley, are common to all

rocks, in greater or less degree: no one of them is without a character of its own, which character is uniform and constant, distinguishing it from all other rocks.

And, on the other hand, try the deposits of rivers, or the products of volcanic eruptions by these tests, and it will be found that the first are all amorphous or chance medley, and the second all mere glass or cinder. They afford no evidence of formation, no internal structure: there is no connection to be established between them and crystals, or pure earths. The deposits from rivers never have any other character than that arising from a mixture of clay and sand: the lava and scoriæ of volcanoes are all either glassy or cindery. They have no other constancy than the negative character of being wholly unlike any true rocks; and, in all their forms of irregularity, evince an utter want of law, as clearly as all the regular formations evince the presence of law when they were deposited. It was this that enabled Humboldt in the Andes to draw the line between the lower regions which consist of true rocks, and the upper regions which are volcanic. And although these upper regions are many thousand feet in thickness, there was no approximation in appearance to true rocks—the original mountain masses and the ejected volcanic masses remain still, and ever must remain, unmistakably and totally distinct from each other.

We bear in mind the fact that Sir James

Hall converted chalk into limestone, and saw-dust into coal, by heat under pressure; but this is a fact which does not apply. For you must have the chalk in purity and the wood without earth, neither of which the alluvium of rivers will supply: and you must have *pressure* as well as heat, which is contrary to the idea of each stratum being a *superficial* deposit, and subversive of the doctrine of *succession* with long intervals, on which all the notions concerning such lengthened periods of *time* are founded.

There is an experiment of De Saussure on record, in which the wood of the pinus abies, grown on a granite soil abounding in silex, yielded on analysis more than thirteen per cent of silex, and forty-six of carbonate of lime; but the same species of tree grown on a calcareous soil yielded no silex, and sixty-three per cent of carbonate of lime. And there is an experiment of Sir J. Hill, who exposed a stoney deposit to aquafortis till all the calcareous matter was dissolved, when the silex remained as a thin transparent film, retaining the exact shape of the stone with all its angles and indentations. These are the kind of facts which seem most to bear upon the question of regular formations, and of the petrifaction of animal and vegetable remains. What we mean will be best understood by those who are acquainted with petrified trees, which are common in many districts, especially among coal strata, and also in the

Portland limestone and Hastings sand. In these fossils the texture of the woody fibre remains; but the ligneous substance is gone, and its place is supplied by perfect stone, having such tokens of rock formation as we have spoken of above. Some of these fossils retain the woody fibre throughout; but in others it is retained in part, and has given way in other parts of the same specimen so as to present in one mass, wood, and compact limestone, and black flint, and quartz crystals—all these being as perfectly characterised as if they were found in distinct blocks. This marks a stage far beyond agatized wood and cannot be rendered intelligible by infiltration, or any process which we can parallel with the operations now going on around us. And such difficulties are met with by examining nature on a large scale, and become of course so much the more formidable. A practised eye will discover at a distance what are the prevailing rocks of a district, by the grand outlines of its mountain ranges: the pyramidical summits indicating one great class—the rounded summits another class—and the table lands with precipitous sides another; and all these with their numerous subdivisions are not in any sense accidental varieties—they all indicate distinct formations, each having laws of its own. No one law will embrace all these distinct formations: each has its own characteristics, traceable to laws which apply to it alone: and

none of these formations can be accounted for by materials derived from aqueous solution, or deposits from a mechanical suspension of the ingredients in water: nor does their consolidation at all resemble that produced from the fusion of earthy particles by volcanic heat.

In many of the broad faces of cliff, which are found on our south-western coasts, raised beaches appear, like bands of shingle, from a foot to a yard or more in thickness, running horizontally between massive beds of the solid rock, high up in the cliff, and far above the present level of the sea. Such a raised beach occurs at Nelly's cove, near New Quay, Cornwall, at an elevation of near thirty feet above high water mark. "The remains of sea beaches are found similar, in all respects, to those on the neighbouring shores, but which are now displaced; and, owing to a change in the relative level of sea and land, are elevated above high water mark, often as much as forty or fifty feet." (*Ansted* i. 21). These raised beaches are sometimes consolidated by a calcareous cement, as between Porthalla and the Nare point—"in which the raised beach has become so consolidated that the sea has worn out a cave upon the top of a small fault under the beach that supports a head of angular fragments derived from the hill above, where the continuation of the grauwake beds appears." (ii. 138.) There exist, also, in similar exposures of lower portions of

the same coasts, evidences of subsidence of the land below the present level of the sea—such as whole forests appearing to stretch far below any known low water mark. These submarine forests are so abundant on the Devon coast, that "it is difficult *not* to find traces of them in this district at the mouths of all the numerous vallies which open upon the sea." (i. 23.)

These instances are adduced by geologists to infer from them that other agencies have been at work beyond those agencies of which we know anything by experience—beyond those the effects of which we can calculate, or the time of which we can measure. This is precisely our argument throughout: we assert that all the geological phenomena are beyond our reach at present, and that no sufficient explanation of any of them has been given. This one phenomenon is allowed to be inexplicable; but it is endeavoured to pass it off as an exception, when in fact it is only an illustration of the rule. "It must not be supposed that in every instance, where a change of level is produced, and a tract of land elevated or depressed, the change was accompanied by an earthquake, or occurred in the immediate vicinity of a volcano; so far is this from being the case, that there is reason to believe in the existence of gradual and slow movements, by which a whole continent may be affected, in addition to these occasional outbreaks." This is something like an *et cetera* to

mystify, or form a make-weight at the end of an insufficient argument, by which a simple and modest man may be silenced, or may feel abashed —since it implies that sufficient reasons have been given, but there are plenty yet in store, if men are still so obtuse as to require them. "There is *reason* to believe in the existence of gradual and slow movements, by which a whole continent may be affected:" and there is *greater reason* to dispute the existence of such movements—certainly in the case of England; and even if such movements are admitted, they would not explain these facts: for you have two *opposing* classes of facts to explain—the *raised* beaches and the *submerged* forests—*both* occurring on the *same* coasts, and often within sight of each other. Granting a slow movement to raise the beaches *upwards*, there must be another slow movement to sink the forests *downwards*; and these occurring not merely within the limits of a continent, but even of a county. It was necessary to make the movements slow to account for the horizontal position of the beach; it was necessary to exclude earthquakes and volcanoes because there are no appearances of disturbance; yet the explanation attempted is to us wholly unintelligible. It is said "we can easily imagine that the land may have been, by the same *oscillatory* movement, elevated in one spot and depressed in another at no great distance" (23). With such an imagination it is

not our fortune to be gifted. We had been taught at school that oscillation was moving to and fro in the horizontal direction; but geologists can easily imagine it to be up and down in the perpendicular direction. We know of no kind of motion that will answer their reasoning so well as the dancing up and down of the keys of an organ under the hand of the player; for we are of Hamlet's mind, and think that they are often playing upon their auditors.

Although these statements are so self-contradictory as to be worthless for sustaining the system which they are meant to uphold, they embody facts which are valuable, and make concessions of which we may avail ourselves in refuting the objectionable parts of that system. A submarine forest is found in the basin of the Tay, where stumps of trees have been covered by a bed of shingle containing marine shells. "The overlying marine beds correspond to those which have received the name of raised beaches, and they offer as distinct evidence of *recent elevation* as the submarine forests do of *depression*" (ii. 21)—that is, the marine beds covering *trees* prove a recent elevation of the sea to reach that level, or of the land to be raised to that height, and the trees, having necessarily grown on *dry land*, prove by their position a recent depression. But surely this proves too much for the geologists, since, if these overlying beds correspond to the raised

beaches, it follows that the raised beaches also are "recent;" and what then becomes of the argument for long protracted periods, and the gradual and slow movements spoken of already? But we pass this to come to general facts.

Many of these beaches lie, nearly in horizontal positions, between beds of solid rock—as that near Porthalla in Cornwall, with the same grauwake formation under it and over it. Such instances as these are sometimes adduced to prove that the rocks above and below the beach were formed in the sea, as the beach itself which lies between was confessedly formed on the sea shore: but the instance proves quite the contrary—proves that the rocks were not formed by that agency to which the beach owes its origin; for, if both had the same origin, they would be indistinguishable: either the rocks would have continued shingle like the beach, or the beach would have been consolidated into the same substance as the rocks. The beach lying between rocks, yet retaining its own character, proves that the rocks were never formed from such as it, or it would have become such as they are: it has remained unchanged, though exposed to the agency by which the rocks were formed: it was, therefore, prior to their existence, and it subsisted through those convulsions which constituted and arranged them. Jamieson and Maculloch noticed, long ago, similar raised beaches, between beds of basalt, in the western isles of Scotland. We presume

that scarcely any geologists will, at this day, dispute the volcanic origin of basalt; yet, with as much propriety might its marine origin be inferred from these instances as from those of the coasts of Cornwall, the marine origin of those rocks.

The dirt beds at Portland also come under the same category as the submarine forests. The trees thus imbedded, between layers of solid stone, do prove that the formation of stone has proceeded *after trees existed*—after forests had covered the surface of the earth; but they prove also that these forests have been *suddenly* enveloped with the stoney matter, and that the hardening took place before the trees themselves had time to decompose, and lose their form and fibrous structure; and they prove that it was not heated lava in which they were enveloped, since such heat would have destroyed all traces of organization still more effectually than the slower process of humid decay. We require in all these cases consistent explanations in agreement with known facts, or a confession of ignorance: and though we may not have an explanation to offer, we can neither concede to one theorist that the sea has been repeatedly changing its level to suit his hypothesis; nor concede to another theorist that lands have oscillated and continents have danced up and down, because he can easily imagine such a thing. We require proof, and from undisputed facts.

Another very important question arises, con-

cerning vegetable matter imbedded in rocks or strata of any kind—which is, whether they are in the localities where they grew, or whether they have been brought from a distance? The greater number of submarine forests have probably grown on that part of the earth where they are now found, the place on which they grew having sunk thus much below its former level. But some of them may have been large floating islands, like those which are carried down the great American rivers by floods; and which may have grounded in the low situations where they are at present found. Most of the peat bogs may be accounted the remains or accumulations of forests which have grown in those localities; but not so the vegetable matter which has furnished materials for our great deposits of coal. We know that the peat bogs consist of trees still growing in these climates, the hazel, the willow, the oak; and the accumulation is not beyond what trees growing upon the ground might be expected to afford: but the coal fields indicate a tropical or at least a foreign vegetation, of which tree-ferns, stigmariæ, and sigillariæ form the type: while the vegetable matter required to form a single bed of coal is so enormous that it could not possibly grow in the place where the coal is found, but must have been brought together from very extensive tracts of country, to be heaped and consolidated in those hollows, or basins, which contain

the independent coal formations. The quantity required, combined with the necessity of its being undecayed in order to form coal, renders it impossihle that forests growing on the spot, for however long a time, could furnish the materials: for the ground at one time cannot sustain more than such a number of trees as would be quite insignificant for such a purpose; and one generation of trees must die and decay, and become incapable of being turned into coal, before another generation could spring up to take its place; and the growth of no one generation growing in that space would suffice for the smallest seam of coal, as there they lie, tier over tier, some of them of enormous thickness, in all the great coal fields. When vegetable matter is accumulated, even in considerable quantity, but not under pressure, it only becomes peat: when subjected to any degree of pressure, in moderate quantity, it only passes into stone, or manifests a slight tendency to coal, as at Portland, and still more so at Bovey. It is only when accumulated in large quantities, and subjected to great pressure, that it becomes perfect coal, and these are almost always found to be basins of mountain limestone resting upon old red sandstone, very appropriately called "the independent coal formation."

Peat always rests upon a bed of clay, but it lies near the surface. Coal has for its floor a bed of clay filled with stigmariæ and similar

vegetable impressions; but the still more important accompaniment of coal is a very solid basin of rocks, of vast thickness below the coal measures, and enormous mountain masses lying over them above. The great pressure to which the coal has been subjected is indicated by the abundance of faults, and lifts, and contortions, which are met with in all the workings, and the coal generally improves in quality according as it has been most heavily pressed, the deepest workings, or "lower delve," being always the best coal in a district, and the superficial seams being in general altogether worthless. Trees are often found in the shales and sandstones which lie above the coal, but generally tossed about in all directions, always stripped of their smaller branches, and seldom of coal, but generally of the same nature with the bed in which they lie. In a few instances they have roots, but more commonly they are broken off short, like the corresponding stumps in the Portland dirt bed: and the appearances are as if the few which held by the roots had been exposed to some tremendous rush and crush, as if a liquid mountain had overwhelmed them at once—an idea which is strengthened by frequently finding marine shells in the superincumbent strata. However this may be, all the appearances indicate that the agency by which the beds of coal were deposited was not tranquil, and that both at the time of formation, and after the beds had

become coal; these districts have been subjected to great violence and convulsion.

The wood found in peat bogs is often undecayed, having sustained no other change than that of colour: it is black as ebony, but makes excellent furniture. When trees have lain in the London clay they become for the most part pyrites, which is often the case when they are found in lias and in the shales which lie between the beds of coal. In gravel pits and beds of sand the wood becomes a mass of silex; and in limestone it becomes sometimes a calcareous, sometimes a silicious mass, retaining only the fibrous structure of the wood—none of its other properties—and often losing even this last trace of what it had been, and becoming compact stone, or a bunch of crystals. These facts prove that peat will preserve wood for an indefinite length of time; and that, in the other instances, it is not time that has wrought the change of the wood, but circumstances; for the change depends upon the nature of the bed in which the wood has lain. All trees found in like circumstances have undergone a similar change into pyrites, or silex, or limestone, according to the nature of the bed. The peat has warded off the decay, which, if the wood had not been thus protected, time would most assuredly have effected. And so it is not time that has converted other trees into coal, sandstone, silex, lime, or pyrites: these changes are owing to

the nature of the several beds, which produced a simultaneous and apparently a very rapid change on all the trees which had lain in the same strata: that is, the mixture in which they were imbedded wrought the change, and that exactly in accordance with the ingredients which entered into the composition of that mixture. But the change is such as could be effected by nothing short of chemical agency; therefore, the ingredients were held in chemical solution in the several mixtures, and not merely mechanically dissolved in water; for the change is no kind of infiltration—it is chemical incorporation or substitution. And it should be observed that, in many of the pieces of petrified wood, the decay of the wood *had already begun* before the chumps were thus imbedded, and many pieces are worm-eaten; yet in these decayed and worm-eaten pieces the petrifaction is just as complete as in those pieces which had been sound wood—all shewing that we are not to look to anything, save the bed itself, to account for the petrifaction of wood.

These facts concerning fossil wood apply to all other fossils, whether corals, shells, or animal remains: the things themselves were some of them living, some empty shells, or only bones of animals, when they were engulphed in their several beds; yet all further decomposition became arrested in all alike, and all alike have taken that permanent form of stone we see now,

dependent solely on the mineral contents of the beds in which the fossils are found. In some of the beds, which contain saurians and fishes, there is the clearest evidence that life has been suddenly destroyed by the influx of a deleterious mixture, suffocating instantly every living thing within its extent; and in these cases the fossils consist largely, sometimes entirely, of pyrites. We believe that this, which was obviously and indisputably the mode in which living beings were surprized to become fossils, in some instances, was really the mode in which all fossils were converted from the flexible, elastic, or germinant and expansive and productive attributes of organic matter, into the fixed, unalterable, dead condition of inorganic matter; in all its forms, thus distinct from, and not to be confounded with, the mere matter apart from the life which belongs to organized beings of any kind.

As in the case of wood, so in all other fossils, it is to the nature of the beds in which they lie that we must look for the source of the materials of which the fossils now consist—for those mineral ingredients, of various kinds, which have taken the place of the vegetable or animal matter, and yet retain the external form of organized beings; while not only for the chemical power to act upon the fossils, but also for the materials and consolidation of the beds themselves, we must have recourse to some other

source than the older rocks, and some other principle than mechanical suspension in water: the simple earths to be derived from the older rocks are not sufficiently numerous or diversified, and a mere deposit of such earths would never consolidate. Some chemical agency is necessary for the least of these effects, and the effects are frequently so powerful as entirely to dissolve the fossil itself; so that madrepores, corals, and wood, melt, as it were, into the stoney mass in which they lie at one end of a specimen, while the organic form remains at the other end, in all the sharpness of the most characteristic specimens.

Sir John Hill, and the older writers, who had no theory to support and who reported their plain facts and minute circumstances with great accuracy, had a more true conception of the nature of rocks, and the mode of their concretion, than we usually find in the writings of the present time. He draws a distinction between natural sands and those which are formed from the decomposition of rocks, finding the former to be homogeneous when examined by the microscope, and to consist of particles of *the same* shape, whether small crystals or less regular particles and globules; but finding decomposed rocks to yield very impure sands, and the particles to be of no determinate or constant shape, but mere irregular fragments: and he strongly argues that neither the natural sands nor the

decomposed rocks can, under any circumstances which we are acquainted with, become stones :–

"A sort of sand is produced at this time..... stone is daily converted into sand, if that gritt may be so called.....but no observations I have ever made can at all authorize the believing that stones are produced at this time, or that sand is or ever can be, in the present state of things, turned into stone." And speaking of the conglomerates, with nodules of quartz, he says —"The stone composed of them seeming to have owed its coalescence merely to this, that its constituent matter, having first concreted into these granulæ, which we call its gritt, they sunk together in the fluid they were formed in, and before they had acquired their proper hardness, pressing upon one another, and cohering wherever they came in contact.....Let not this system be misunderstood to favour or at all authorize the general error of supposing strata of stone to be formed at this day out of sand, clay, &c. Sand, originally loose, can by no agent now in force be ever made to coalesce into stone, nor can any cement avail for effecting this. Clay and sand can only make loam: water impregnated with spar, falling upon a stratum of sand, finds free and open passage, without depositing any part of its contents; and there is no stone the gritt of which will agree with any of these common sands" (434-435).

The more numerous and more scientific ob-

servations of modern times have only more confirmed the observations of Sir J. Hill, and convince us that the cohesion between the granulæ of all stones is an element of their first formation, and that it is not effected by the introduction of another substance to cement or bind together particles which had been originally loose and separate; and, consequently, that if this cohesion be destroyed, if rocks be decomposed, such a *debris* will not coalesce into stone by time, or by any natural agency at present known; and still less will natural sands cohere, nor can any salt or fresh water bind them into stone. It was in speaking of the gritt-stones that Sir J. Hill made his remarks on the composition of rocks; and it is in this class of rocks, even to the present time, that mistakes have been most frequently made. The gritts are very numerous in reality, and occupy very distant positions in the geological series; but, in general appearance, they so much resemble each other that considerable local and practical knowledge is necessary to distinguish the different groups. To say nothing now of the newer sandstones, it is notorious that many enormous groups had been till very lately confounded under the one common designation of old red sandstone. Hugh Miller removed the mistake of supposing that this great formation was destitute of animal remains, though he also regarded it as one vast deposit of many thousand

feet in thickness. But to Sir R. Murchison we are indebted for distinguishing several well-marked divisions, classed as the Silurian and Devonian groups; and more recently a Permian group, spreading over a large portion of European Russia.

We have no doubt that these distinctions are well founded, and expect that other distinctions will appear in this great formation, either co-extensive with the sandstone wheresoever it is found, or local and not capable of identification with those already known, and so requiring a local name like that of Perm, last adverted to. There is one point to which especial attention should be directed in constituting subdivisions of a great formation like this, so as to distinguish one group of beds from another group—namely, the natural breaks which occur; that is, when the dip of one group varies greatly from the dip of another group with such constancy as to shew that the groups have been differently acted upon, and acted upon in the mass, and not as separate strata. If the beds forming one group are conformable to each other, and are all raised in a mass to a high inclination, and another set of beds are conformable but in an horizontal position, this indicates disturbance in the former case, and comparative tranquillity in the latter, which may prove sufficiently characteristic to separate the groups.

In what we are now saying one great group is present to our thoughts which has not, we believe, been as yet considered to be so distinct from the rest as it appears to be—namely, a mass of conglomerate, lying between beds of micacious shale and clay, in most cases of great thickness and with a high angle of inclination, which group forms the basis of all the *regular* coal formations of England, and lies between the mountain limestone and the upper Silurians. This bed of conglomerate dips under the limestone at a higher angle of inclination than it, as the limestone again is more inclined than the coal beds; but they all may be regarded as more conformable with each other than any of them are with the Silurian beds beneath them. The conglomerate dips towards the centre of the coal field at an angle of twenty-six to thirty, forming a vast bowl. It has the appearance of sinking under the weight of that immense accumulation of mountain masses which constitutes the coal field above, or the edges may have been raised by an explosive force acting from beneath, and finding vent between it and the Silurian groups. To this last idea we rather incline, because in many places, while the bulk of the conglomerate is dipping under the limestone at an uniform angle, certain portions of the higher edges of the bowl have fallen back in the other direction, as if they had been raised by an explosive force, which, having got vent, left them

unsupported, and they fell back by their own weight into the hollow which the explosion had made. However this may be, there are marks of separation here which ought to detach this group from the old red sandstone, and couple it with the carboniferous series, as the lowest member of the coal field.

We have no doubt that those geologists are right who have maintained that the coal measures are local and partial formations, and are only to be found at certain depths below the surface, being strictly independent; although where they do occur it is between the two great deposits of oolite and red sandstone, by which we mean that wherever coal is found regularly deposited the old red sandstone will be found under it, and, in many cases, oolite above it; but that it does not follow from this that wherever red sandstone and oolite are found there will also be coal. In extensive districts of this description coal is wholly wanting; and, therefore, the carboniferous group ought not to be regarded as one of a geological series in the sense of being constantly found, but only as occupying a certain place in the series in those cases where it does come in.

None but those who have studied the sections of many coal fields are fully aware of the great disturbances which have taken place in this whole group of strata—far greater than in the old red sandstone below, or the oolite above, the

coal formation. We allude not to the whin dykes which, like the gigantic faults of primitive districts, are traceable across whole countries, and cut through coal and everything else in their course. We speak of disturbances which are peculiar to the coal formations, and do not extend to the adjoining strata on either side. In the Jarrow colliery, Durham, there are seven upcasts of the same seams within a short distance, some of eighteen and twenty-five feet, and one of six fathoms; and some of the seams are bent as if compressed into a shorter space, and one is actually splintered from the force. Such instances are frequent; but they cannot be made intelligible without diagrams. The limestone beneath the coal shows the same marks of disturbance, and is often cut through by rivers, as by the Wye at Chepstow, and by the Avon at Bristol, and so is open to our observation. The St. Vincent's rocks at Clifton afford a good section of the limestone dipping at a very high angle under Bristol, abutting on the old red sandstone upon which Cook's Folly stands, and covered by the newer conglomerate and marls which appear at the water's-edge, below College Green, near St. Augustine's Church. Numerous faults and slips appear both in the St. Vincent's rocks and in the quarries on Durdham Downs, and these rents are filled with conglomerates, consisting of fragments of the limestone itself, and of the

lias and sandstone above—fragments of all sizes, and some of them fragments of other conglomerates—the whole cemented together by calcareous spar, and capable of polish.

The lias group, as a whole, stands higher in the geological series than the carboniferous group; yet this breccia, which fills the rents in the limestone, would seem to indicate that a turmoil was going on while the whole carboniferous group was forming, which had not subsided till the lias was formed, but swept into its vortex portions of this latter to fill the faults and hollows of the limestone and all the intermediate beds: and still more striking proofs of this occur at Tenby, and along the whole of that coast to Pembroke. The limestone is generally very full of madrepores, encrinites, and corals; and these are sometimes found in the conglomerate which fills the faults. All the fragments bear such relation to each other in position and shape as to lead to the inference that many of them were joined together, and have been broken in being jammed into the place where they are found; and sometimes they are compressed as though the substance had been yielding, or in a soft and vitreous condition. Some of the fragments thus divided contain the two halves of a madrepore, divided only by a vein of spar, and forming one compact mass, clearly showing that the division took place in the act of forming the stone.

In order to come to a just conclusion concerning the formation of all strata, and the agencies by means of which the various geological phenomena have been produced, it is important to mark those groups in which disturbances of an extraordinary kind, such as those just mentioned, occur; for this may lead to distinguishing separate acts of formation at considerable intervals from each other, which might suggest an arrangement of the numerous strata into distinct groups, each of which groups might contain some typical characteristic common to all its strata, and thus forming a generic distinction between group and group. This may be the case with reference to formations alone, and without regard to the mineral character or fossil contents of the strata, or those other minutiæ which might constitute specific differences, and furnish marks for subdividing the groups.

There seem to be three groups in the geological series, during the formation of which these signs of extraordinary disturbance appear. The first is that consisting of gneiss and the slaty rocks which lie between granite and the old red sandstone, and which the older geologists called transition rocks. The contortions in these have forced themselves upon the notice of all observers, and are to be found in Lyell and Ansted, and all the other writers on geology. The second is the carboniferous group to which we have

been adverting already: and the third consists of the Hastings and green sands, and other strata, which lie immediately beneath the chalk formation; and between the first and the second of these groups occurs the well-marked formation of old red sandstone; and between the second and third the equally well-marked oolites; while the chalk marks off the strata which lie above the third as distinct from all that are below it.

Gneiss, the lowest member of the first of these distorted groups, is less known than the other members of the same group, being difficult of access, and neither in itself nor in its contents of sufficient value to induce men to explore its structure, that they may turn their knowledge to account. Clayslate, from its great value, has been very extensively worked, and is known to have features in common with gneiss and micaslate in its *bedding;* while in its *structure*, which gives it the *slaty* cleavage, a law of formation has existed which is peculiar to clayslate, and found in no other formation. The bedding of gneiss, micaslate, and clayslate, is very irregular, deviating continually from the horizontal position, and often twisted and doubled together in a very remarkable manner. In all these distortions the particles of the two former are arranged in the *direction of the bedding*, and when they split at all it is in this direction, more or less approaching to the

*horizontal;* but clayslate, on the contrary, has its particles arranged in a direction *nearly perpendicular*, without any regard to its bedding, and consequently always splits in a direction nearly at right angles with the splitting of gneiss and micaslate. This is certainly owing to a law of the nature of crystallization, and the slates themselves often become unequivocally crystalline.

The rocks which form this group, from the semi-crystalline structure they present, have been called metamorphic, on the assumption that the bedding involves sedimentary deposition, and that the crystalline structure therefore requires a change to have been afterwards produced by volcanic heat. It is assumed that water first deposited the beds in horizontal layers; and that the distortions were next produced by convulsions without heat, affecting the whole formation, because the beds are all conformable with each other, however much they may be raised or twisted; and then, lastly, that the slaty structure was produced by heat without convulsions, because the structure is regular, and the same in the most disturbed beds, as in those which are nearest to the horizontal position. The hypothesis has these three stages—one of bedding, one of convulsion, one of metamorphosis, which are to be kept distinct; for if either be mingled with, or affected by, the other agents, the hypothesis breaks down, and does not agree with the facts.

For all the beds being conformable, the sediments for the *bedding* must have been deposited *horizontally* to ensure this conformity, and must have been all deposited before any one of them was disturbed; both because this is the only way in which regularity of deposit is conceivable, and because water must finish its work before the work of fire can begin. And the first act of the fire is supposed to be convulsion, without alteration of structure; to be lifting and deranging the bedding of the whole formation, by the power of fire, without imparting heat to the beds thus distorted: and the second act of the fire is supposed to produce the metamorphosis or change of structure which converts it from a mere deposit into clayslate with its perpendicular cleavage. It is shown by trap dykes destroying the slaty structure, when they cross a bed of slate, that *such* a degree of heat would be too great: and it is assumed that the heat which accompanied the convulsion did not alter the structure—therefore, *that* heat was very small, so that we see it is a very ticklish operation. There must be no metamorphic heat during the time of convulsion, and there must be no convulsive heat, or trap heat, when the time of the metamorphosis has begun. But how all this can be we leave the geologists to explain.

The second instance of these distorted groups —the coal measures—has several peculiarities. First, there seems to have been an outburst

between the conglomerate, which forms the lowest member of the carboniferous series, and the old red sandstone: the effect of which has been to turn up the edges, all round the coal-field, especially the conglomerate and lime-stone, so as to form large basins, in which the coal seams lie. Secondly, the coal beds, and intervening shales and marls, are thickest in the *central* parts of this basin, and thin out all round towards the *circumference;* some of them wholly dying away before they reach the surface, as all of them would reach the surface at the edges if they continued, because all the strata are basin-shaped. These appearances are in favour of the idea that the various sandstones and marls, which are sometimes found above the carboniferous strata, sometimes around and apparently below them, and which it is hardly possible to distinguish from each other in mineralogical character, have had in truth the same origin; and that accidental circumstances have placed some of them within the carboniferous basins, while others, being outside, have appeared to belong to the old red sandstone on the one hand, or the lias on the other hand.

The third great disturbance occurs under the chalk, and above the Hastings sand: and whereas the two former disturbances have left evidences of accumulation, in great formations which took place at the time of those distur-

bances, this third, on the contrary, is chiefly known by its denudations, and the destruction of formations which had previously existed. There are strong grounds for believing that the coal-fields have sunk in the centre, partly from a vacuum beneath, partly from accumulations above; but there is no ground for believing that the limestone and conglomerate, which form their basis, ever much exceeded their present extent: but there is every reason to believe that the chalk was once continuous from the Shakspeare cliff to Beachey Head, and that the north downs of Surrey and the south downs of Sussex were once united, until that denudation, which constituted the Wealds, swept away all the chalk which lay above the Hastings sand. The chalk *en masse* remains undisturbed, but its edge is turned up along the whole line of the outburst, and the strata thus broken up have been all swept away, so that not a trace of them at present remains. This solidity of the remaining chalk may be partly owing to its bulk, which is so enormous that it is computed to form one-eighth of the surface of the earth—an extent compared with which the denudations appear insignificant: whereas the carboniferous strata are partial and limited in extent, and almost all greatly disturbed: but in the apparent quiescence of the great mass of the chalk, we have evidence of these disturbances and denudations taking place after the earth had assumed its

settled form—after the chalk, and the strata above it, had become consolidated: and what was manifestly the case in these strata, we think was probably the case in the other instances; and that such manifest disturbances of the order of succession invalidate all the inferences which have been built thereon concerning protracted periods of time: and, although the general tendency of this last outburst was for denudation, yet there may have been some instances of accumulation, as partial elevations above the chalk, or more extensive lodgments in its hollows and valleys; for, concerning the chalk, and all other formations, of whatever age they may be, we assume that they always had these inequalities, since we can form no conception of the earth existing at all under any other conditions than the present proportions of land and water—of vapours rising from the sea to purify the atmosphere, and condensing again upon the mountains to return in rivers to the sea, keeping up a constant circulation—of the like proportions of hill and dale, not only for water courses, but for variety of soil and climate, without which the different species of vegetables and animals could not subsist; and of the existence of which living beings, we have proof in all the times of which we speak.

Our object at present is only to use incontrovertible facts as arguments against the prevailing system of geology: and to offer such sug-

gestions as may occur, from the consideration of these facts, as may lead to some better arrangement; and the first step towards the true arrangement would be, the distinguishing between such formations as are of great extent, and have some claim to be regarded as universal, and such as are limited or partial, and, it may be, solitary or local. On those formations which seem to be universal, the more limited formations which seem to belong to them might be arranged so as to form a series, and the partial or local beds would be an after consideration: but the very term "*universal*" is to be used with the qualification of remembering that we, as yet, know but a very small portion of the earth's surface, and all our notions must be open to correction; and there is no term we use throughout in which such a qualification should not be borne in mind.

While geologists continue to regard all strata as formed in one way, and all in regular sequence, and therefore all as universal formations (for the two ideas are inseparable—universality must follow as the consequence), no true advance in the science can be made—no true representation is given of the existing phenomena. But it appears probable that, when any right grouping of the strata takes place, we may find the fossil contents of great importance in keeping the groups distinct from each other, as we have already found their importance in distin-

guishing stratum from stratum. As strata have their peculiar and characteristic fossils, so there may be fossils common to a whole group, which may distinguish it as clearly as if it were a single stratum.

If we regard the chalk as being entitled to be called an universal formation, and make it the foundation of our uppermost group, every one knows that echini are the fossils which especially characterise chalk: but echini are found in all the beds above the chalk; in the London clay of Sheppy, and in the gravel-pits of Norwood, and Sydenham, and Kensington; and we are not aware that echini are met with in any stratum which lies under the chalk, except in a few instances of the beds which cover the oolite, and these are so rare as scarcely to form an exception; therefore, it may happen that echini would sufficiently distinguish this whole group.

The oolite, with the soft limestones of like kind, is a formation nearly as extensive as the chalk, and might serve for the foundation of another group; and of this group it would probably be found that the cornu ammonis was the distinctive fossil. The old red sandstone, in like manner, might be regarded as the foundation of the carboniferous and liasic group, and the granite as the foundation of the remaining one: and even, if characteristic fossils should not be found in these, the negative distinction arising from the absence of the fossils of other

groups, or the paucity of fossils altogether, might prove to be distinctions sufficiently characteristic.

The partial formations we allude to are found in isolated masses, and connected with disturbed districts, so as to render it probable that they have been ejected; yet not as lava, but more like those muddy eruptions which have sometimes occurred in Mexico and Peru. We regard clayslate as a partial formation, so also many of the older rocks, as serpentine and crystalline limestone. The local formations are in like manner connected with disturbances, and are often characterized by fossils, which, if not unique, are of very rare occurrence elsewhere. "The bed of death" (as Hugh Miller calls it), with its strange contents, is one of these local instances. Dr. Mantell's iguanodons of Tilgate is another, and the saurians, in the Lyme Regis lias may also be another instance; and we are persuaded that more accurate investigation will greatly increase the number of local, and, perhaps, also of unique formations.

There is one fact to which sufficient prominence has not been given, but which justifies all we are saying, being inconsistent with the ordinary notions of stratification, and absolutely requiring some such outbursts as we mean—namely, the discharge of liquid rocks from the bowels of the earth, without volcanic—that is, vitrifying heat. The nearest approach to what

we mean was the eruption of mud at Lima within our own time: and somewhat similar were the outbursts in Auvergne and Dauphiny, in the middle of the fifth century, which are still commemorated by the Church in the Litany and Rogation days; but these last are not strictly parallel, because they were truly volcanic, yet even these have not been repeated. The fact we allude to is, that the formations we have instanced are notoriously and indisputably at higher elevations than the granite and other rocks from whence they are supposed to be derived. On the common hypothesis, as derivatives, they should unquestionably be of lower elevation than their sources; yet they rise far above the primary rocks. Snowden is the highest mountain in Wales: this, on the geological theory, ought to consist of granite, or a primary rock from whence the secondary rocks might derive their materials: but it is not a primary rock, nor is it volcanic, for casts of shells are found in its shaley strata to the very summit. There is granite at its foot in Anglesea, but not one-fourth the height of Snowden: and the highest granite of Cornwall does not rise to one-half the height of the secondary rocks of Wales—nay, even the carboniferous rocks of South Wales rise higher than any of our granites—therefore, it is a physical impossibility to derive materials, in the way proposed, from our granite, seeing these primary rocks, which ought to be the highest, rank among the

lowest in Britain: and the fact is brought into a still narrower compas by the outburst beneath the chalk between Reigate and Godalming; for Leith-hill, near Dorking, consists of Hastings sand, which, in geological language, has its proper place full five hundred feet below the level of the north and south Downs; yet Leith-hill rises full two hundred feet above the north and south Downs, and commands a view of both from its summit. Here is a case of palpable upheaving of the lower strata, without any volcanic symptoms: and, not far from Leith-hill, it will be remembered, is the Tilgate forest, where the iguanodons were discovered; and all the strata rise to an anticlinal axis down the centre of the denudation, which fact entirely refutes the idea, thrown out by Dr. Mantell, that a river, like those of the tropics, had once rolled down this valley of denudation, on the banks of which the iguanodons had basked and died. The supposition is a physical impossibility—it calls the chicken into being before the egg is laid. There was no valley till after the chalk was swept away by the upbursting of the sand—till after the country had put on its present appearance: and, as a similar denudation re-appears on the French coast near Calais, this convulsion preceded or accompanied the separation of our island from the continent, and before that time there was no mouth for a river—the Straits of Dover did not exist.

Another class of facts deserves a more parti-

cular examination than it has yet received—viz., the occurrence of some strata, in almost every group, which are destitute of fossils, and that sometimes in the midst of strata in which they abound. The old red sandstone was once supposed to be destitute of fossils, and till very lately the existence of them in this group was known only to a few. It is now well established that, in certain of the beds, they are abundant; yet, it is still correct to say, with reference to the extent of the formation, that they are of less frequent occurrence in this than in the other fossiliferous groups, and large portions of the formation seem to be without organic remains of any kind. The peak of Snowden is full of shells, but is surrounded by strata destitute of them: and even in the chalk there is a great difference in this respect between its upper and lower beds, all of which differences have yet to be accounted for in any true hypothesis.

If it should turn out, on careful examination of these classes of facts, that there are *quiescent* as well as *disturbed* strata, and *that* constantly and *characteristically* so, and that these bear such relation to each other as to account for their being disturbed in the *one case* and quiescent in *the other;* and if it should appear that a *different mode of formation* is uniformly indicated by the presence or absence of fossils, or by cleavage, or by crystallization, or any other

constant character; and if, moreover, a distinction can be drawn between formative convulsions and destructive convulsions—that is, between ejections by which strata have been formed, and convulsions which have only broken up the strata in order to their being swept away: if these things should be made manifest, then we can conceive the possibility of explaining existing phenomena, in accordance with the Mosaic account of the Creation and of the Deluge. But until it is seen and acknowledged that we must have recourse, not merely to the surface, but to the bowels of the earth, to find materials for the great formations, the mere facts cannot be accounted for—much less can principles be established; and, as Christians, we cannot admit any principles which are not in accordance with the plain letter of Scripture.

Every notice that appears of the geology of other lands leads us to expect that, in proportion as we become better acquainted with other countries, so what we already know will require to be modified; that formations which are regarded as universal will be found wanting in other localities, and that new formations will appear of which we are ignorant. Geology, which professes to be an universal science—professes to give an account of the constitution of *the whole earth*—cannot be allowed these claims until the structure and arrangement of the strata *in all parts of the earth* have been

examined. It has begun in our hemisphere, and may agree very well with what we know —it may disagree with the facts of the other hemisphere, and may be utterly refuted by its phenomena whenever they shall become known.

The works which we have placed at the beginning of this article are such works as we hope to see multiplied; and it is with reference to such works, and having these in our mind, that much of the above has been written. The first of these works is especially valuable, both as being a careful survey of countries concerning which we can only say that we are just beginning to know something, and also because it is the production of a man who is at the same time competent to observe, and so unbiassed by theory as to give us the full and fair report of those facts which came under his observation. Nothing is slurred over or done in a slovenly manner—he seems to have had his eyes open to all the phenomena, and to have recorded carefully all that he met with.

Some of the facts concerning the geology of New Holland and Van Diemen's Land, which are now brought to light by De Strzelecki, may prove not a little embarrassing to those who are wedded to a system, or have committed themselves to a theory; but they are such as we have been all along expecting, and which will, we believe, come out more and more as dis-

tant countries shall come to be examined, and especially countries of the southern hemisphere. We are not surprised at learning that the geology of New Holland and Van Diemen's Land differ so greatly from each other; or that both differ so much more from our northern geology, which we have been too much in the habit of considering as the type of the order prevailing over the whole earth.

Everything tends to suggest or confirm the opinion that the southern hemisphere differs in all respects from the northern—in climate, in natural productions, and in geology: and New Holland especially seems to be the land of paradoxes, if it may not be reckoned altogether one great paradox. It is a vast continent almost without mountains, almost without rivers, almost without trees, almost without inhabitants; and its few plants and animals were not only distinct from the known productions of the earth and the animals with which we are conversant, but they were for the most part so unlike as to be perfectly paradoxical; so that Home, and the other anatomists, suspected that a trick was being played off when some of these strange shapes were first submitted to their examination; and now it appears probable that some degree of scepticism will be excited among our scientific men of another class, as it comes into manifestation that the geology of this strange country is in harmony with the rest of its features, or at

least, in this respect, that it is unlike the geology of other countries.

Though we are at present very imperfectly acquainted with the geology or the fossils of Australia, all that we do know, and especially that information which we have most recently acquired, and chiefly from the work before us, favours the idea that our notions must undergo a complete revolution, and that especially concerning extinct animals. We have already heard of the bones of gigantic birds from the interior of New Zealand, which the natives declare to be abundant, and to belong to creatures which lived in the days of their fathers; and some fragments of bone have been examined by Professor Owen, the results of which examination are now given, connecting these fossil remains with animals now existing of the kangaroo and marsupial classes which are so characteristic of Australia—so different from the animals of our hemisphere. The man from whom some of these fragments were obtained stated, "that similar ones, and larger still, might be got further in the interior; but that, owing to the hostility of a tribe, upon whose grounds the bones are to be found, it was impossible for him to venture at that time in search for more" (312). On the astragalus of one of these fossils from Australia, Professor Owen says—"Viewed in reference to the general characters of that bone in the mammalian class, it offers great and

remarkable *peculiarities;* and we further find that *these* are *exclusively*, but most *closely* repeated in certain *Australian genera* of marsupialia, and especially in the bulkiest of the existing vegetable feeders, which are not saltatorial. The inference can hardly be resisted, that the rest of the essential peculiarities of the marsupial organization were likewise present in that still more bulky quadruped of which the fossil under consideration once formed part" (310).

Speaking of another of these fragments, Professor Owen observes—"I know of no quadruped that so nearly resembles the present large Australian fossil as the wombat; and the molars of the kangaroos, in their double roots and double ridged crowns, are those amongst the marsupials which most nearly resemble the molars in the present gigantic fossil" (302). "We may conclude that the foot of the great extinct marsupial possessed that degree of rotatory movement which, as enjoyed by the wombat, is so closely analogous to the pronation and supination of the hand. We finally derive from the well-marked marsupial modification of the present fossil astragalus, a corroboration of the inferences as to the former existence in Australia of a marsupial vegetable feeder as large as the rhinoceros." "The present bone is from the alluvial or newer deposits in the bed of the Condamine River, west of Moreton Bay, Australia"

(312). Other of the fragments were got at Boree, and came from the interior.

Similar facts are brought to light in the flora of the Australian coal measures, which we have not room for in detail; but the results are given in the following summary:—"In reviewing the few species of the ancient flora that have been hitherto collected from the carboniferous deposits of Australia, including therein the fossil plants from the basin of the Hunter, in New South Wales, and those from the Jerusalem Basin, in Van Diemen's Land, we at once perceive the interesting fact that, although limited as the species are in number, there is *no trace of any of those remarkable genera so characteristic of and so abundant in the strata of the European and American coal fields*, such as Lepidodendron, Sigillaria, Stigmaria, *Calamites*, *Coniferæ*" (251). "The basins themselves, if indeed contemporaneous, appear to be characterised by *a distinctly localised flora; no species*, as far at least as our observations have extended, being found *common to the two deposits*. In comparing, therefore, the whole of the species at present known from these deposits with the coal plants of Europe, there appears, indeed, to be but few, if any, analogical forms." "These few observations partly lead us to infer that the flora of the southern hemisphere was perfectly distinct in its facies from the northern at the carboniferous period; just as, at the present time, the modern flora of the same continent presents a striking

difference to that of other portions of the globe" (252). "It is desirable that the local geologists may be stimulated to make a good collection of these fossil plants, so that a careful comparison may be instituted with those of northern Europe" (250).

Though we are only using this volume at present in confirmation of the general principles which we have been advocating for several years, for which purpose the facts it discloses are very important, yet we cannot omit the opportunity of saying that it is, in all respects, a valuable addition to our knowledge of those distant colonies of our countrymen which have risen into importance with a rapidity not to be paralleled anywhere, save in the colonization of North America. Australia may be called another new England, though Great Britain is but as a speck in comparison—may be regarded as the new world of the nineteenth century. The main object of Count Strzelecki's visit to New South Wales was to examine its mineralogy: it was to him an unknown region: he was without guide or guide-book. He passed many years in the survey, travelled seven thousand miles on foot, yet, though neither perseverance nor devotion to the pursuit were wanting, "they have procured for me (as he modestly avows) only the consciousness of how little I have done, and how much is still needful to complete such a delineation as the geology of the present day requires." Such modesty is to be ascribed to a strong

perception of the much that is desirable to be known, rather than of the little which is actually known. The additions made by this volume to our previous knowledge are many and most important. The geology mapped and described reaches one hundred and fifty miles inland, and stretches from the thirtieth to the thirty-ninth degree of south latitude. The descriptive parts of the survey are arranged in four epochs, and the map is coloured accordingly. "The mineral constituents of each epoch are distinguished by a strictly mineralogical nomenclature, in preference to a geological, as the latter cannot, as yet, be applied to Australian rocks without involving questionable analogies, or implying identities with eras of deposition in other parts of the world" (52).

We would also give what publicity we can to the following statement:—"I have also prepared a geological map of New South Wales and Van Diemen's Land, upon which I have laid down and illustrated what the present description will relate in words; but that map I am unable to take upon myself to publish." "It is twenty-five feet long, and five feet in width, and is on the scale of one-fourth of an inch to a mile" (54).

The description of the scenery, often of the most singular and romantic description, into which the survey carried our author, is given with graphic power; and he speaks very fa-

vourably of the hospitality, frank and kind-hearted though rough, which he met with in the mountains, liberally offered, while all pecuniary recompense was refused. A more favourable picture of the colonists is given than we expected on the whole: but instances of shameful spoliation and massacre of the natives are also recorded with the just indignation of one who feels as a man, and who, as a Pole, has experienced in person, and witnessed in his own land, similar wrongs without the same excuse of being perpetrated in savage regions; and he copies, with proper commendation, a dispatch of Lord Glenelg, severely reprobating such barbarous practices, and forbidding their repetition.

The products, agriculture, and resources of the colonies are detailed; and magnetic and meteorological observations are given. In short, we must quit the subject, for the present, by saying that we could only do justice to the contents of this volume by a lengthened review, of which it should form the only topic.

Mr. Lyell's work is such as we might expect to receive from one, not only thoroughly acquainted with geology, but who has written several systematic works; and who, therefore, though looking at a new country with an intelligent eye, looks at it with reference to the confirmation of facts already known, or blanks to be filled up in that system. The freshness and

impartiality of an ardent novice sometimes more than compensate for inexperience in a case where it is actual observations that are principally wanted, and where we have already found the evil of speculation. Nor is America so likely to furnish the variety or the contrasts which may be expected to be found in the southern hemisphere: yet there are some facts which are applicable to our purpose:—

"On our way home from Charleston, by the railway from Orangeburgh, I observed a thin black line of charred vegetable matter exposed in the perpendicular section of the bank. The sand cast up in digging the railway had been thrown up on the original soil, on which the pine forest grew; and further excavations had laid open the junction of the rubbish and the soil. As geologists, we may learn from this fact how a thin seam of vegetable matter, an inch or two thick, is often the only monument to be looked for of an ancient surface of dry land, on which a luxuriant forest may have grown for thousands of years" (i. 180).

We entirely agree with this, and would say, not only for thousands but for millions of years, if it will better meet the contrary argument; for a forest could not *continue* to grow if the accumulation become greater than a few inches in its depth, because the seeds which must form a rising generation of plants, to supply the place of those which die of age, must be able

to reach the soil *beneath* this accumulation, and root *in the soil* in order to become trees; and this they could not do, if the accumulation exceeded a few inches in depth. But in a preceding page, speaking of the anthracite of the Bear Mountain, it is said:—"The vegetable matter, which is represented by this enormous mass of anthracite, must, before it was condensed by pressure, and the discharge of its hydrogen, oxygen, and other volatile ingredients, have been probably between two hundred and three hundred feet thick. The accumulation of such a thickness of the remains of plants, so unmixed with early ingredients, would be most difficult to explain on the hypothesis of their having been drifted into the place they now occupy; but it becomes intelligible if we suppose them to have grown on the spot" (i. 86).

We do not so much refer to this for the contrast it presents to the above extract, as for the purpose of expressing our dissent from it *in toto*. We had thought it an established fact, from Sir James Hall's gunbarrels, that the effect of pressure was to *prevent the escape of the volatile ingredients*, and that *thus only* could vegetable matter be converted into coal; and the accumulation of drift is only inexplicable by those who will think of nothing more than the drift of rivers, and have made no account of the effects of an universal deluge. Then, how is it easier to conceive the vegetable matter to have been

*so unmixed*, by supposing the trees to have grown on the spot? Surely, they did not grow in the air! Surely, they did not grow in mere dead leaves! They must have had a soil to root in, and increase, and multiply.

In examining the footprints in the red sandstone of the Connecticut river, which is supposed to belong to the triassic group, or occupy a place between it and the coal, and which are in successive layers at different intervals, to a depth of twenty or thirty feet, with a dip of eleven to fifteen degrees, Mr. Lyell "cannot conceive such markings to extend through a thickness of twenty-five feet, without supposing a subsidence of the ground to have taken place from time to time during the deposition of the layers on which the birds walked" (i. 253). We think the supposition would only solve one of the difficulties suggested by these footprints, even if we allowed that to be a difficulty which is merely the consequence of a particular theory of stratification: but we quote it on account of the sensible remarks which follow:—

"This sandstone is of much higher antiquity than any formation in which fossil bones, or other indications of birds, have been detected in Europe. Still we have no ground for inferring from such facts that the feathered tribe made its first appearace in the western hemisphere at this period. *It is too common a fallacy to fix the era of the first creation of each tribe of*

*plants or animals, and even of animated beings in general, at the precise point where our present retrospective knowledge happens to stop.* The discoveries in Connecticut ought to teach us extreme caution in deducing general conclusions from mere negative evidence, especially when we infer the non-existence of land-animals from the absence of their remains in contemporaneous marine strata."

Would that the words we have printed in *italics* stood as the motto for every treatise on geology! Would that geologists had borne in mind that man is one of those animate beings, concerning whom we should exercise extreme caution in deducing conclusions from mere negative evidence!—above that of all other land-animals, the caution applies to the era of the creation of man.

Many passing remarks in these volumes tend to inculcate similar caution—as speaking of the difference in the fossils of strata, which in other respects seem to be contemporaneous, he says:—

"When we consider how remarkably the *species* of the Suffolk crag differ from the shells of the contemporaneous faluns of the Loire, the geologist will not be surprised to learn that I have only met with nine American miocene shells, agreeing with fossils of the same period in Europe. It is also worthy of notice that the shells identified with recent species agree with

testacea, now living on the western side of the Atlantic, some of which are forms peculiar to America. In like manner, the fossil shells found in the miocene strata of Europe, which agree with recent kinds, belong to species inhabiting the British seas, the Mediterranean, or the African coast of the Atlantic. Hence it follows that, at the remote period called Miocene, the seas were not only divided as now into distinct geological provinces, but already that peculiar distribution of the living mollusca, which now exists, had begun to prevail. This conclusion is remarkable, when we recollect that, at the geological era alluded to, the fauna was so distinct from the present that four-fifths of the species, now living, had not yet come into existence" (i. 138).

This does not state the contrast strong enough; for nearly all the plants found in the strata of Europe belonged to a flora only found at present between the tropics, and nearly all the animal remains are in climates where such animals could not now exist—elephants, along the shores of Siberia, as well as in England and America; crocodiles and hyænas, in our gravel beds and caverns; horse-bones in America, and elks in Ireland. It is not easy to reconcile these palpable diversities of climate, which the hypothesis of plants growing, and animals living, where their fossil remains are found, necessarily involves, with the idea of the seas being divided,

*as now*, into distinct geological provinces—with their living mollusca distributed, *as at the present time;* but looseness of thought in all respects slips in, through the loose manner in which geologists are accustomed to speak of time; for when they speak of *recent* species, it means, at the very least, thirty-five thousand years ago, which is said to be "a much more probable conjecture" than that of Bakewell, which was only one-third of the time that would be required for the retreat of the falls of Niagara from the escarpment of Queenston to their present site (34). Whether we take twelve thousand or thirty-five thousand years thus vaguely, it produces a vague idea that, during such a length of time, things may have happened which we should at once perceive to be incompatible, and therefore impossible, if they were fixed to any one definite point of time. The land it is which divides the sea into distinct geographical provinces; and, if the distribution of the inhabitants of the sea was the same as at present, at any given time, this infers the temperature, depth, and other physical requisites were the same; and it ought to follow that the inhabitants of the land, and their physical requisites, were also the same as at present, and the land must be under the same laws of temperature and climate as the sea.

But geologists seem to think that they can deal with a whole continent as a plaything—can change its climate at pleasure, and lift it up

and down, and dispose of its mountains and vallies, and lakes and rivers, according to their own convenience. Mr. Bakewell handled the district between Lakes Erie and Ontario, with the Falls of Niagara, in one manner—Mr. Lyell handles the same little toy in another :—

" Some geologists have considered these facts as very difficult to reconcile with the glacial theory. To me they appear to indicate the following succession of events :—First, the country acquired its present geographical configuration, as far as relates to the outline of the older rocks, under the joint influence of elevatory and denuding operations. Secondly, a gradual submergence then took place, bringing down each part of the land successively to the level of the waters, and then to a moderate depth below them.....Thirdly.....the clay, gravel, and sand of the drift were deposited, and occasionally fragments of rock, which had been frozen into glaciers, or taken up by coast-ice, were dropped here and there at random, over the bottom of the ocean, wherever they happened to be detached from the melting ice. During this period of submergence, the valleys in the ancient rocks were filled up with drift, with which the whole surface of the country was overspread. Finally, the period for re-elevation arrived, or of that intermittent upward movement, when the ridges.....were formed in succession, and when valleys, like that of St. David's, which had

been filled up, were partially re-excavated" (ii. 101).

We leave this without comment to the good sense of our readers; but we congratulate them on learning, from the same authority, that the earth is cured of these intermittent fits, and has had no relapse for thirty-five thousand years. For we are told concerning the "big bone lick," that "it is impossible to view this plain without at once concluding that it has remained unchanged, in all its principal features, from the period when the extinct quadrupeds inhabited the banks of the Ohio and its tributaries" (ii. 67).

But, though we speak thus lightly of the crochetty parts of these volumes, we would not have our readers conclude that they are worthless. They are, on the contrary, full of valuable observations, and sustain the character which Mr. Lyell has acquired as one of the most able and indefatigable of geologists: these are but specks and blemishes, which do not materially lessen the general value of the work. We wish that they were not there; but, as inseparable from a system, we tolerate them—if that pursuit of a favourite system has produced zeal and perseverance, and a collection of minute facts, which, but for it, we might never have known. And to part with Mr. Lyell, under favourable impressions, we commend the following most important passage to our readers:—

"In regard to the rarity of marine vertebrate animals in the oldest rocks, it may perhaps be no greater than is observed in strata of more modern date, formed in seas of equal depth, or at points as remote from the land. Many years have not elapsed since the old red sandstone was thought to be barren of ichthyolites; but now, in addition to the numerous genera found in Scotland by Mr. Hugh Miller, M. Agassiz has announced that nine genera of sharks, of the division cestracion, occur in the Devonian beds of Russia, examined by Sir R. Murchison and M. De Verneuil. The appearance of fish so highly organized, in some of the oldest formations, is strongly opposed to the theory of progressive development advocated by some writers, and imagined by them to derive support from recent geological discoveries.

"Professor E. Forbes, after acquiring much experience, by dredging in the Mediterranean, of the fauna which characterises the sea at different depths, has inferred that the Silurian seas in those areas, hitherto examined, were at first very deep and tranquil, although, in parts, they after grew shallower. The following are the principal grounds of this conclusion:—first, the small size of the greater number of conchifera; secondly, the paucity of pectinibranchiata (or spiral univalves); thirdly, the great number of floaters, such as Bellerophon, Orthoceras, &c.; fourthly, the abundance of brachiopoda; fifthly,

the absence of fossil fish; sixthly, the deep water forms of most of the sea-weed; and seventhly, the absence of land plants" (ii. 57).

All these facts we shall have occasion to use on a future occasion, but to a purpose very different from that to which they are at present applied, and in connection with other facts which are not yet fully developed; and, in the meanwhile, thank Mr. Lyell for the varied and important information contained in his volumes, which we have read both with pleasure and profit.

# CHAPTER VI.

FIGURES AND DESCRIPTIONS OF THE PALÆOZOIC FOSSILS OF CORNWALL, DEVON, AND WEST SOMERSET: BY JOHN PHILLIPS, F.R.S.

WE have only one more point to bring out at the present time on the subject of "Scriptural Geology," but it is the most important point of all: it is that which we have had in view from the beginning, and for the sake of which all that has hitherto been urged was written—viz., the bearing which it has upon theology: and we would now request the especial attention of our readers, while we endeavour to show that this is a religious question, and that, if we are not upon our guard, the foundations of faith may be undermined while we may only be thinking of science, and mean to be engaged merely in the pursuit of a branch of natural history. If we had regarded geology solely as a branch of natural history, or had thought it possible for any one to be engaged in its study and able to limit himself to its scientific bearings, we should not have discussed this subject at so much length, or with so much earnestness, in a journal professedly clerical, and devoted princi-

pally to ecclesiastical questions: but we have not to enquire how far it might be possible to avoid religion in treating on geology: the fact is, that it has not been avoided; and being, therefore, obliged to regard this as a religious question—and one in which theology is deeply and intimately concerned—we felt very strongly upon it; and we endeavoured to show in what respects the popular systems were faulty; wherein they ran counter to acknowledged principles of science on the one hand, and the plain declarations of Scripture on the other; and were, therefore, untenable in both respects: and we now desire to consider what are the true theological bearings of geology, and what ought to be assumed as fundamental principles by all who profess to believe in divine revelation, either as it respects the Old Testament or the New; for the revelation is one from beginning to end: it is one harmonious plan—prepared at the creation, to be accomplished in the new creation—the old was the germ of the new—the new is the development of the old.

It is not a matter of surprise that men of science should overlook the theological bearing of their facts, any more than that theologians should be unacquainted with or misunderstand some of the facts known to scientific men. It is rather to be desired that different classes of men should be taught to feel their need of each other, by feeling each to want something which

he must call upon another to supply: besides, not only are the subjects of enquiry different in which these two classes of men are occupied, but the region is itself different. Theology is a spiritual region; the men, therefore, who handle theology must be spiritual also. The mere crossing of the threshhold of Christianity is passing into the spiritual region—a region totally distinct from the natural region: and, therefore, Christ gave glory to his heavenly Father, who had thus revealed to babes things which had been previously hidden from the wise and prudent: and St. Paul, in like manner, declares that they cannot be known by the mere natural man, and seem foolishness unto him, because they are spiritually discerned. The sciences belong primarily to the natural man —this is his proper province: religion and theology, in the highest senses, belong to the spiritual alone.

Questions may arise requiring, for their satisfactory discussion, a knowledge both of theology and of science: and it is unfortunate when such questions are taken up by men of science, who are unacquainted with the religious bearings; or by religious men, unacquainted with the scientific bearings of the question; for, being thus partially apprehended, the real point is not perceived: and two such halves cannot make a whole, and if they attempt to amalgamate, it will only be that the man of science may back

his own crude assertions on theology by the authority of his religious friend, and *vice versâ*, while each will be afraid of disclaiming such an appeal, because it is made by an ally. Each, knowing only his own province, shrinks from intruding on the province of the other, and fears even to correct what he knows to be rash, crude, or erroneous, lest, in correcting an error, he should be unconsciously marring the system of a friend.

Geology, considered merely as a science, is embarrassed with one peculiar difficulty—we have no means of testing the truth of its inferences by existing facts, or operations still going on. It is not like astronomy, which gives an account of the daily and hourly courses of a machinery still in operation, the truth of which every one may test by observing the present motions of the heavenly bodies. It is not like botany, or any branch of natural history, the subjects of which we may still find living, growing, multiplying according to known laws, and regulated by present times and seasons. It is not like chemistry or experimental science, where we can repeat or vary the experiments, and may predict or verify the results. Geology has to do with a machinery, the course of which is stopped—the parts disjointed and lying in fragments—and which we neither know how to put together, nor can compare with anything analogous. It is a *caput mortuum*, whose pro-

portions have been altered in the shock by which its life became extinct. It is a laboratory on so gigantic a scale, and with such stupendous results, that we can neither attempt to repeat them, nor truly conceive how they have been effected, or what might have been the consequences if it were otherwise. The facts of geology lie as the wrecks and ruins of what once was, in a state of things no longer in existence; and it is like questioning a range of mummies in a sepulchre, to endeavour to extract an answer from these facts—the thoughts, feelings, and affections of the mummies may be more nearly inferred than can the former constitution of the earth from geologic facts.

While astronomy was merely guess work—as it was until the time of Newton—even those who guessed right had no certainty to appeal to, and could not call upon others to receive their assertions. It was by the discovery of a law which explained all the phenomena that were then in operation, and applied also to the past, that astronomy became a science and was fixed on an immoveable basis: and until such laws are discovered for geology we cannot regard it as a fixed science—we can only regard it as guess work, resting on greater or less probability, according to the ingenuity of the professor; and, whenever such laws are discovered, they will be in harmony with Scripture. If conjecture is hazarded now, it will be at best beside

the mark, and it may be of an infidel tendency, directly or indirectly contravening the Scripture record.

It is because we have a scriptural record of creation, which we have not of the foundations of any other science—not even of astronomy, the noblest of sciences—and because, to understand the new heavens and the new earth, we cannot but take into consideration how the things which we behold came into their present situations—and because, therefore, this enquiry touches upon revelation as well as science, that it is both difficult and hazardous. The Scripture, however, declares no more than abstract truths concerning the constitution of things, leaving the facts in detail to be observed and collected by us: while science begins with observation, and ascends to general principles and abstract truths, the correctness of which must depend upon our being imbued with a knowledge of God, and of the purpose he designed to accomplish by the creation: which purpose alone, be it remembered, rendered it necessary to make known the acts of creation by divine revelation; for there is no more necessity for revealing the details of the earth's creation than the details of the creation of the sun, and moon, and stars—*save for this*, that there are *duties* resulting from a knowledge of the former, while there are none which result from the latter; and, to assist us in the right discharge of our

duties, revelation is given, not to gratify mere idle curiosity.

Man, as the image of God, has duties towards his Creator. Man, as invested with dominion over all other creatures, has duties towards the creation. Man and woman, as representing the greatest of all earthly mysteries—the mystery of Christ and the Church—have reciprocal duties towards each other. The Sabbath, the first of religious institutions, embodies the record of creation, and in its letter testifies to the letter of the six days' work—the time of work being as literal as the day of rest which commemorates it. Adam's naming the beasts embodies the right of dominion conferred upon him; and Eve, taken out of the side of Adam, puts the stamp of reality upon the divine mystery of the oneness of Christ and the Church—one in flesh, as Eve was with Adam. Then, again, the fall we need to know, not only to justify God, but to prize and use aright the means for our recovery. God made the world very good, and thus it stood while man believed God and obeyed His commands. The brute creation, being without reason, were incapable of sin—a moral agent alone could come under such a responsibility as to contract guilt; but the penalty extended beyond the guilty party—to the whole creation which was headed up in man: and Adam, disobeying God, beheld His lordship fearfully manifested, in that the penalty which he brought

upon himself passed upon all the living creatures which were under him. Nay, the very ground was cursed for his sake—doomed to sterility, or the rank incumbrance of thorns and thistles; while man was doomed to wring his bread from it with the sweat of his brow, and to toil in sorrow and pain all the days of his life; and between him and the brute creation dread and mutual enmity were implanted, of which the enmity between the seed of the woman and the serpent was the prominent sign: while, to keep before the eyes of man the consequences of his sin, and to be also symbolical of that redemption, which, in the fulness of time, should be brought in, sacrifice was instituted, which might not only work repentance, but be also an expression of faith. And man, in confessing over the sacrifice that he, by his sin, had deserved the death which the victim that could not sin was made to undergo, was pointed forward in faith to apprehend that spotless sacrifice which God had fore-ordained—even the Lamb of God, which taketh away the sin of the world: death being first manifested in this way, because this was the purposed way of mercy; and God clothing the first sinner with the skin of the sacrifice, to indicate that Christ's righteousness is the sinner's covering.

But the fall of man brought ruin not on himself alone—the ruin was as extensive as the dominion of man. He was made in the image of

God, and was, in the visible and limited sphere of this world, the representative of what God is in the invisible world, and throughout the universe. Let us suppose an impossibility by way of illustration. Suppose, for an instant, the possibility of God relaxing his hold on the universe, and who does not see that his universal dominion instantly goes to wreck? In like manner, when God's vicegerent on earth fell from his place, the whole of this *cosmos* was brought into confusion; and but for the upholding hand of God, who had a purpose of mercy to accomplish, and a higher glory still to manifest in the recovery, all would then have rushed headlong into destruction, with man foremost, in the sin and in the punishment.

This is no speculation—we feel the truth of St. Paul's words—we *know* "that the whole creation groaneth and travaileth in pain together until now;" and, on the same grounds, we are assured that "it was made subject to vanity not willingly"—that is, not by its own fault, but by the sin of another. And we are assured, likewise, that it shall be recovered, and that not by its own efforts, but by the deeds of another; therefore is there hope under the misery—therefore can we wait—therefore can the creation wait, for the manifestation of the sons of God, to be delivered from the bondage of corruption under which it now lies oppressed; for, if by one man's offence death reigned by one,

much more they which receive abundance of grace, and of the gift of righteousness, shall reign in life by one, Jesus Christ. This *reigning* is not without its emphasis: it is promised equally to *all* believers; they do not then reign over *each other;* but, as they must have subjects, it indicates the recovery of that dominion given to man at the beginning, but which Adam lost by the fall; and it is a rule of blessedness, for rulers and subjects will be in the places for which they were created. It is also true liberty —all being, by nature, in slavery to those who are not their rightful masters—to the powers of this world, and the spirit that worketh in the children of disobedience. But the creation shall be delivered from the bondage of corruption into the glorious liberty of the sons of God. This deliverance is the consummation to which all prophecy points our faith—when the lion shall lie down with the kid, and a little child, because in the image of God, shall lead them. At that time none shall hurt nor destroy, because the knowledge of the Lord shall cover the earth as the waters cover the sea. In the Gospels this is called the regeneration, the resurrection, the time of the restitution of all things, or the world to come, in contradistinction to the world that now is; and thus the new creation shall present a perfect counterpart to the old, in the blessed effects of restored headship and dominion under Christ, the second Adam; and God shall at

length be vindicated, and it shall be acknowledged that he doth all things well: he shall be glorified in those works of his hands which were finished from the foundation of the world, and man shall enter into that rest which remaineth for the people of God.

We may feel assured, that, when we find a revelation to consist of a connected series of facts like the above, this connection is necessary to render the revelation complete, and to bring out the doctrine for the sake of which that revelation was made; and, therefore, that, in order to bring out the mystery of the kingdom of Christ—which is the new creation under the second Adam—every link of connection between the first creation and the first Adam must be kept entire; and not only so, but that succeeding revelations concerning the new creation and the kingdom of Christ may be used to reflect back clearer and stronger light upon the revelation concerning the first creation, because they answer to each other in all particulars as type and antitype. Thus, should we entertain a question concerning the relative importance of being informed of the facts concerning our creation, more than the creation of the heavenly hosts which seem so greatly superior in glory to this world of ours, the Psalmist answers the question prophetically in the eighth Psalm; and St. Paul takes it up doctrinally, in the second chapter of the Epistle to the Hebrews, the

point of which is, that God hath constituted Christ heir of all things, and *that*, as Son of Man; and that by him, and for this end, the worlds were made; and though we see not yet all things put under him, it is declared that such shall be the case; and when he bringeth again his first begotten into the world, all the angels of God shall worship him. Thy throne, O God, is for ever and ever: a sceptre of righteousness is the sceptre of thy kingdom. Thou hast loved righteousness, and hated iniquity; therefore, God, even thy God, hath anointed thee with the oil of gladness above thy fellows (Heb. i. 2-6-8; ii. 6; iv. 3-10; 1 Cor. xv. 27; Psalm xlv., lxxii).

The Son was, from all eternity, the brightness of the Father's glory, the ruler of all things, and infinitely above the angelic hosts, receiving, as God, their continual worship. The assertion of *this* truth is not the point of the Epistle to the Hebrews. The point is that he, in taking our nature, had made himself for a time lower than the angels for the suffering of death; but that, in rising again, he is exalted far above the angels, and manhood thus highly exalted in him; and all this, in order that, as Captain of our Salvation, he may bring many of those whose nature he hath assumed to the same glory; by doing which he is accomplishing that which the Psalmist declared, saying, "O Lord, our Lord, how excellent is thy name in all

the earth!—who hast set thy glory above the heavens:" being the glory for which the creation with man at its head was originally intended (Psalm viii).

The specific purpose for which all things were thus prepared at creation was not frustrated, it was only delayed, by the sin of man; and the Gospel prepares mankind now for the accomplishment of that original purpose at the second advent of him who is the second Adam; and this truth has been attested in the intermediate ages by other acts of God which have no true significance except as they are thus regarded. The sin of Adam ran its natural course in the antediluvians, enlarging continually till the judgment of God burst forth in the deluge. But the judgment, being universal, shews that the whole creation was visited therewith on man's account, and as headed up in man; and, on the other hand, the preservation of Noah shews that he was saved as the federal head, not only of the human race, but of the living creatures preserved with him in the ark; for when the iniquity of the earth was full, God visited with judgment not only the sinners, not only all mankind, but all flesh: the beasts of the earth, and the fowls of the air, as well as the children of men; because they all, as under the dominion of man, were regarded as implicated in man's fate, and must undergo the same common judgment.

And after the flood, to preserve a witness for this doctrine, of man's being head of the creation in the new world, Noah, the only righteous man, *saved his house* by his faith, condemning the world, and becoming heir of the righteousness which is by faith (Heb. xi. 7). His sons and their wives were covered by the faith of Noah—nay, even the birds and beasts, both clean and unclean, were saved in the ark in consequence of Noah's faith: not because God could not have created others had it so pleased him, or could not have destroyed mankind alone, and spared the brutes, had he seen fit; but these were saved, together with man, to show that the whole creation was bound up with man in one common destiny; and all to keep inviolate, until the coming of Christ, this grand principle of federal headship—that as all things were made by and for Christ, and in him who is before all things, they have their consistency (Col. i. 17); so his work may be proved sufficient for the ends predetermined; and not to have been so marred by sin—not to have been so mastered by Satan—not so annihilated by the deluge, as to constrain God to cast off his first creation in order to create a second, a more enduring, and better ordered machinery, and that to effect the same purpose; or to be constrained to change the purpose, from not being able to construct a machinery of sufficient power and sufficient endurance to accomplish it.

When Noah came forth as head of the post-diluvian world, God made a covenant with him, including in it not only all mankind, but all the living creatures, and even the earth itself; setting his bow in the clouds, and pledging himself thereby no more to destroy the earth by a flood, and promising to keep the seasons for the time to come in their regular courses. Thus carefully has revelation preserved to us the continuity of the same original purpose, and secured our interest in the creation standing of man, and shown the interest which the faithful among the antediluvians had in Christian hopes and promises; for God spake unto Noah, and to his sons with him, saying, "And I, behold I, establish my covenant with you, and with your seed after you, and with every living creature that is with you, of the fowls, and of the cattle, and of every beast of the earth with you, from all that go out of the ark, to every beast of the earth."

We might pursue the same examination of Scripture, and find the same principle maintained in God's dealings with Abraham and the children of Israel; but want of space, and the necessity of taking some considerable scope in applying the principle, prevent it. But our readers will fully understand what we mean by referring to the concluding chapters of Leviticus, and the song of Moses in Deuteronomy.

Now the modern theories of pre-Adamite creations, each independent of the others, and all in

endless succession of alternate destruction and renewal, are not only contrary to this one harmonious scheme of revelation, but they are absurd, as being purposeless, causeless, fruitless —originating in no assignable reason, leading to no assignable results: they present one interminable series of wanton havoc and unmixed suffering, which it is a libel on common sense to attribute to God, and can only be consistently ascribed to some demon. Such a medley of unmitigated ferocity, and wholesale destruction, as the geologists picture, may with consistency be ascribed to Satan; but we will not allow it to be ascribed to the God of Love whom we adore.

And these theories do not only contravene the truths of revelation as principles, or regarded as one system, and forming one whole—they contravene every separate point of divine revelation, from first to last: not only creation, but the deluge, and the ten commandments, and the Sabbath: not only the fall, but the restitution of man: not only Providence, but Deism, and the existence of anything beyond or above the material and visible things around us. Many of the advocates of these speculations are not aware of their thoroughly infidel tendency; but it is because they are either bad logicians, or shrink from carrying out their principles to the fair and legitimate conclusions. The proof of this lies at hand in the writings of one who is in holy

orders, and was a Savilian professor at Oxford, who has drawn a comparison between the Mosaic account of creation and the geological hypothesis, and states the result as follows:—

"In offering this imperfect summary of the general results derivable from *geology*, which bear upon the subject of *creation*, we conceive enough may have been stated to enable the discerning reader at once to perceive the nature and extent of the discrepancy which exists between the changes, thus incontestably disclosed to us by the existing monuments of past ages of terrestrial existence and the entire character and scope of the descriptive narrative of the creation in the Hebrew Scriptures. We referred to certain interpretations of that narrative which have, in truth, been framed expressly with the view of attempting to reconcile the contradiction. After all we have before said, we shall not think it necessary here to press the matter much further on the notice of our readers; they have before them the materials for forming their own judgment. We will merely say, for our own part, that we fail to perceive how those interpretations can be supported on any rational basis so as really to explain the discrepancy, or effectually to defend the cause to whose aid they are summoned, since the main points of the discrepancy still remain untouched—viz., that there are no traces of any such catastrophe as must be supposed, even over a limited portion of the

earth's surface, subsequent to the latest tertiary formation.....With regard to the nature and extent of the discrepancy thus disclosed, we would observe that it is not a case merely involving the question of the literal acceptation of a word or phrase.....nor is the difficulty of the same nature with any sceptical objections to a supernatural narration: but it is the contradiction of existing monuments of past events with the *obvious* sense of what is recorded as a part of divine revelation, in the form of a circumstantial narrative of the same events. And the discrepancy is not one with any theory or partial discovery of science, which is not yet thoroughly made out, and which future investigations may modify or set aside; but with broad primary facts which involve nothing hypothetical, and which are in reality identified with the first principles of all inductive truth. It is also a circumstance which, taken any way, involves a train of consequences. It is not an isolated difficulty like that attaching to some single detached point, which we can pass over and not allow to weigh against the evidence preponderating on the other side; but it essentially involves a broad principle, and must affect, in its consequences, the entire view we take of the authority and application of the Old Testament.

"These remarks refer yet more directly to what doubtless was the third and chief object in this representation of the creation—the institu-

tion of the Sabbath.....The narrative, then, of six periods of creation, followed by a seventh similar period of rest and blessing, was clearly designed, by adaptation to their conceptions, to enforce upon the Israelites the institution of the Sabbath: and in whatever way its details may be interpreted, it clearly cannot be regarded as an *historical* statement of a *primæval* institution of a Sabbath."

On the deluge the same writer observes:—

"Upon the whole it is thus apparent, that we have no evidence whatever of any great aqueous revolution at any comparatively recent period having affected the earth's surface over any considerable tract.....If we look to the actual tenor of the whole narrative as delivered by Moses, we shall observe that the manifest *immediate* purport of it is the same as that of the rest of the earthly portion of his history—viz., as forming part of the *introductian* TO THE LAW..... some of the *rudiments* out of which the law was framed."

We have quoted the above revolting passages in justification of ourselves for the earnestness with which we have contended against the theories which lead to such results, and the frequency and length of those articles in which we have endeavoured to show that those theories have no foundation in fact. If effects, which are really ascribable to the deluge, have been so misunderstood by the geologists as to be thrown

back in their system to periods incalculably remote, and long before the creation of man—then, of course, the scriptural account of creation, and of the deluge, will not agree with such a system. And which of the two must go to the wall we have no manner of doubt; nor do we believe that any of our readers will doubt, when the question is thus openly brought to such an issue. We are not frightened by big words, about "the first principles of all inductive truth:" for we remember that the very same confident and boastful tone was assumed by the French savans, concerning the antiquity of the zodiac of Denderah; but the first ray of true light which was thrown upon Egyptian antiquities, by Dr. Young and Champolion, was sufficient to clear away the mists of infidelity, and to overwhelm the savans with shame and confusion. We deny that the geologists have any better facts to rest upon in their theory of the earth than Bailly and the French savans had in the zodiacs, and we entreat our readers to have patience, and in due time the same results will ensue.

We have not the least doubt that the extracts given above would honestly express the convictions, though it may be unformed, almost unconscious, convictions, of every intelligent and consistent reasoner, who adopts the facts or accedes to the principles asserted by the geologists; though very few would have the hardihood to

put them in so plain a shape, and thus openly profess them. Granting the facts and principles to be true, this result will necessarily follow; but we deny these *broad primary facts*—we deny that the principles assumed are those *of all inductive truth.* The facts of geology are of two classes—first, the facts relating to the arrangement of the numerous strata of rock—the beds of the earth; secondly, the arrangement of the animal remains—the fossil contents of those beds. It may be granted to be a *fact*, that the arrangement of strata is in orderly succession, but the *mode* in which they were so arranged is *not a fact*—it is hypothetically assumed; yet it is on this *hypothesis*, and not on the *fact*, that men presume to invalidate the Scripture narrative. The classification of fossil remains is a *fact*, but the *mode* of classification is pure *hypothesis*, together with all the supposed catastrophes preceding the creation of man. It is assumed that this arrangement and classification took place before the creation of man, because no human remains have been observed among the fossils, which is an argument that may be overturned any day by the discovery of a human bone or implement. But by this assumption the deluge of Noah is necessarily excluded as an agent; for all these formations are thrown back by this hypothesis to an epoch preceding the creation of man, and then it is coolly remarked that, in the superficial beds that lie above these

strata, there are no traces of any such catastrophe as the deluge, and thus the scriptural record of creation and the deluge is set aside without a scruple!

Let us apply again to astronomy for an illustration; and suppose Tycho Brahe, or any observer of the old school, talking of his primary facts, when he meant thereby not only the rates and periods of the heavenly bodies, but also the hypothesis that they moved round the earth. He might say that this motion round the earth rested on fact—rested on the same observation by which he had ascertained the rates and periods. But we now see how we might admit the truth of his observations in one respect, yet deny them in the other, and separate fact from hypothesis. In like manner we may at present admit the truth of the observations made by geologists concerning the order and contents of the earth's strata, while denying the inferences they have drawn as to their mode of formation and pre-Adamite antiquity: and thus, by separating hypothesis from observation, and putting facts in their proper places, we may find a place both for the creation and for the deluge, so as at once to remove the supposed discrepancy between geology and revelation, and vindicate the authority which intrinsically belongs to the Hebrew Scriptures.

We may grant the accuracy and value of the observations which geologists have made, con-

cerning the relative positions of the various strata, and the fossil remains or other peculiarities of each stratum; but we must separate these observations, which truly are facts, from their assertions respecting the origin or cause of the strata themselves. We have ever denied that there is any evidence of these being sedimentary deposits, in the ordinary sense of the terms; and consequently deny that they afford any measure of time, and therefore deny that they present any contradiction to the Mosaic account of creation and of the deluge.

It is not easy to discover what is the order of succession, in respect of time, which geologists at present hold. This was clear enough in Werner, who reckoned granite, and the deepest seated rocks, as therefore the oldest. It was also intelligible, though not so clear, in Hutton and his followers; who reversed the order of the crystalline rocks, and regarded granite as a formation from beneath, and among the newest of all rocks, except those which are decidedly volcanic in their origin. But the present geologists, in combining the two systems, have the appearance of beginning at both ends, and leaving nothing in the middle; or so shifting the middle term that it becomes an evanescent quantity, and leaves us no foundation to rest on. For granite and the crystalline rocks being deemed of igneous origin—and slate rock, and the whole group that used to be called tran-

sition, being deemed metamorphic rocks—we have no primary rocks whatsoever. The term *metamorphic* implies that the rock was at first a sedimentary deposit from water, which was afterwards changed by the heated mass bursting out beneath, on which it at present rests. The rock on which it lies, and to which it owes its metamorphosis, is, in the supposition itself, implied to be newer than the slate which this igneous rock has changed: whence, then, did the slate derive its original materials? And where can we find any rock whatsoever which we can regard as primary? Where can geologists find any source whatsoever from whence they can derive materials to commence their sedimentary deposits? If the large deposits of clayslate, gneiss, &c., are really metamorphic; and if the granitic rocks are the cause of this metamorphosis, and therefore secondary in point of time to the rocks they have changed; whence could the materials of the clayslate and gneiss be by any possibility derived? It could not be from the detritus of granite, before the granite itself came into existence. It could not be from the simple stratified rocks, for these, as lying over the metamorphic, are supposed to be long posterior. The very materials of the metamorphic rocks are unaccounted for: they are cut off from every possible source of supply, by fire on the one hand, and by water on the other. These rocks are in fact a burdensome

stone to all theorists: Werner did not know what to do with them, and so he called them transition, which meant that they were neither one thing nor another: the moderns call them metamorphic, because they cannot reconcile them with the agency of fire or water: so, to make the matter sure, they bring in both agencies—leaving the contradictions to be reconciled by others, or to remain unreconciled.

Such of the geologists as are candid plainly tell us that none of the geological facts can be accounted for by operations now going on upon the earth, or by any principles of physics with which we are acquainted; and they allow that all the reasonings concerning the mode in which strata have been formed, and the time which would be required for such purposes, are, from first to last, purely hypothetical: having not the smallest warrant in known processes, there being no such formations in progress since the creation of man—the system being based on the denial that there are any.

For the whole system, so far as it clashes with Scripture, rests upon the absence of human remains from all geological strata; from whence the inference is drawn that these strata were deposited before the creation of man. If this inference be correct it shuts us up to the conclusion that the laws now in operation are altogether inadequate to form strata; for in six thousand years not one stratum has been

formed, nor is there a beginning of any such formations. Until something like an approximation to such a result be instanced, and it is proved that this has been effected by natural means, we shall continue to doubt the possibility of strata being thus formed; and hold ourselves warranted in denying that any such strata ever could have been formed by the ordinary laws of nature, and in therefore rejecting the whole theory as mere speculation, or at most as an ingenious but unsupported hypothesis.

And in reference to fossils, also, we would observe that if, according to this hypothesis, stratification were now going on, we should certainly have found some of the present races of animals imbedded in recent strata, and ought even to have found the remains of man himself. The only instances of human remains are, like that from Guadaloupe, so very recent as, by the immense gap they leave, to damage the theory, and leave it in a worse state than if they had never been found. Dr. Buckland supposes (page 104.—*note*), that these Guadaloupe skeletons are the results of a battle fought in the year 1710. Are we, by geological reasoning, to conclude that man was not created till 1710? Or are we to conclude that Guadaloupe is the only portion of the earth inhabited by man? We believe none of these human remains are fossilized; but, in whatever state they are, they either prove too much or too little. If they

are fossilized why have we not more of them, and in the earliest peopled districts of the earth? Was Guadaloupe the first abode of man? And is that mixture of sand and chalk the nearest approximation to a stratum since the creation of man? Or, on the other hand, if these bones are not fossilized, does it not rather strengthen the idea, entertained by many, that human bones are incapable of fossilization?

The believer in that grand truth which gives substance and reality to the spiritual truths of Christianity—viz., the resurrection of the body, is unwilling to see it apparently compromised, by placing the bodies of men on the same level with the brutes, to whom no resurrection is assigned; and we instinctively show some respect to the dead bodies of men, and would be unwilling to suppose that even their bones deserve no higher a place than forming part of the collection in a museum. It should be ever present to our minds that our bodies are called the temple of the Holy Ghost:—"What? know ye not (saith St. Paul) that your body is the temple of the Holy Ghost; therefore glorify God in your body, and in your spirit, which are his." And it should also be remembered that Christ hath taken our flesh, and when risen from the dead bade the disciples to handle him, for assuring themselves that the same body was raised:—"Behold my hands, and my feet, that it is I myself: handle me and see; for a spirit hath

not flesh and bones, as ye see me have." And in that body, thus raised from the dead, he sitteth at the right hand of God; and in that body shall he appear at the last day, and change the living and raise the dead; when all that are found faithful shall be made like him, for they shall see him as he is. Such dignity belongs even to the body of man, who alone of all creatures was made in the image of God.

Christ took our nature that our sins might be imputed to him, in order that he might make an atonement for us and cancel our sins: and, as a consequence thereof, his righteousness might be imputed to all who believe in him. This doctrine of imputation, which forms the ground-work of the Gospel, was foreshadowed from the moment of the fall; first, in the guilt contracted by Adam passing upon the whole creation, though it had not sinned after the similitude of Adam's transgression, who was the figure of him that was to come: secondly, in the immediate indication of the appointed remedy, by the institution of sacrifices; wherein the death of the innocent victim, in place of the guilty sinner, typified the one sacrifice of himself, to be offered by Christ, in the fulness of time, for the sin of the world.

The animal creation had not sinned, but shared in the misery brought in by the sin of man; both because it was the only way in which man could be taught the extent of his

sin, and because it was necessary to hold up to faith, in sacrifices, the way of reconciliation and atonement through Christ Jesus: and not only do we discard the idea of suffering being brought into the world by any other cause than the sin of man, as an unsustained hypothesis, and manifestly contrary to Scripture—we hold ourselves bound to combat it as a libel against God, in thus imputing to him the infliction of so much misery without any apparent or assignable cause: and it is also further objectionable as being subversive of the whole Gospel scheme of redemption through Jesus Christ.

For, notwithstanding the form in which the argument has been put, in order to show that, on the whole, enjoyment preponderates over misery in the brute creation, we hold that any suffering, any death gratuitously inflicted—that is, not as penal—not as the consequence of guilt, is a libel upon God: either it imputes to the Almighty a defect of power and inability to create beings which can stand harmless; or supposes God to be indifferent to their sufferings, and, as all things are done by him, inflicting gratuitous pain and misery. The want of an immortal soul is no argument for it, but quite the contrary; for brutes, destitute of reason, must be regarded as in themselves innocent; moral consciousness is necessary in order to contract guilt; and, if they suffered thus before the creation of man, no sufficient cause appears why it should be so.

It will not suffice to say that the angels are moral agents; and that the fall of angels may have brought sin into manifestation, and death as its consequence upon the brute creation, before man was created; for, not to insist upon the want of a revelation to that effect, and its being therefore mere conjecture, there is no such connection between angels and the animal creation as to implicate the latter in the sin of the former. Among the angels themselves there does not appear to be anything like that standing of federal headship which subsists in mankind as regarded in Adam, or the Church as regarded in Christ: each angelic being singly and voluntarily stood or fell; and this seems to be the cause why no redemption is provided for them: moreover, they are spiritual beings, having no corporeal substance, and the brute creation is merely corporeal or fleshly, and has no spiritual nature: between two such heterogeneous natures, as spirit destitute of substance, and substance destitute of spirit, there can be no connection, in the sense of guilt being imputed from the one to the other. If a connection between angels and anything earthly could be established at all, it would be more likely to subsist between the *human* and the angelic natures, because man is in part spiritual, and not wholly corporeal, like the animals: yet, for the work of redemption, we are expressly and sedulously taught that Christ took not on him the

nature of angels, but the seed of Abraham: it being necessary, even for establishing the connection between the Lord himself and mankind, that he should take a body, soul, and spirit, like that of man: to become truly the second Adam —bone of our bone, and flesh of our flesh: and while we steadfastly hold that this incarnation was a fixed purpose in the mind of God from all eternity, and may have been foreshadowed and typified in various ways—it never became real fact till Christ came, and thus rendered glory to God in the highest: till he who was made of a woman, made under the law, came to redeem them that were under the law, that we might receive the adoption of sons: and now unto us a child is born, unto us a Son is given, on whose shoulders the government shall be, though we see not yet all things put under him; for we see Jesus, who was made a little lower than the angels for the suffering of death, crowned with glory and honour: and when the first begotten shall be brought again into the world, the proclamation before him shall be, "Let all the angels of God worship him." He shall then take the throne as King of kings and Lord of lords; and heaven and earth shall acknowledge him, saying, "Worthy is the Lamb:" "and every creature which is in heaven, and on the earth, and under the earth, and such as are in the sea, and all that are in them, heard I saying: Blessing, and honour, and glory, and power, be unto

him that sitteth on the throne, and unto the Lamb. Thou art worthy, O Lord, to receive glory, and honour, and power; for thou hast created all things, and for thy pleasure they are and were created." And that we may give to this material world of ours its true importance, and to wrest the argument out of the hands of those who bolster their infidelity on the superior magnitude of the heavenly bodies, it should be borne in mind that Christ, the Lord, is the Son of Man, and all this glory to God in the highest is inseparable from peace on earth, and good will towards men. It has all resulted from the incarnation, which mystery was transacted on this earth, and our flesh was the substance which furnished the material body for him who sitteth on the throne of heaven now, and who shall, at his second coming, be manifested as Ruler of the universe, and shall receive this universal homage. By him and for him all things were made: he, as the Lamb of God, redeemed only this world, not other worlds: he passed by the angels; and this act of grace, shown exclusively towards us and our world, stamps a peculiar importance on us and ours in developing the mystery of God. Great was the mystery of godliness; God was manifest in the flesh, seen of angels, &c. Unto principalities and powers in heavenly places shall be known by the Church the manifold wisdom of God. This is the dignity of man—this our high, our vast responsi-

bility as his body: glory to God in the highest was, by the angelic hosts, proclaimed at the incarnation, over an apparently helpless babe lying in a manger; for GOD WAS THERE, embodied in that babe; *even then* the manifestation of the incarnate God began—*then first began:* and though the body might *seem* helpless, the angels beheld *the fulness of the Godhead bodily present there.* Glory in the highest could not but ensue, they might not know how, but God had appropriated to himself a body; none could wrest it from him, for Omnipotence was there; that body must needs rule the universe, for the Creator of all worlds was there: all glory must be given to that portion of creation *first*, which God had *thus* appropriated, and made so inexpressibly near to him as to become the very form of his subsistence. Christ hath not merely taken a body in the sense of appearing in such a form—HE IS GOD-MAN—HE is incorporated thus. As man is not man without having a body, so is Christ inseparable from his body; and in a far higher sense since he is raised, his body hath put on immortality, and infinitely higher since godhead is joined to the human body, soul, and spirit, in Christ. God hath, in the Son, appropriated to himself the whole nature of that glorious creature, which was made in the image of God for this very end.

Creation is truly one system, by which God

will make one revelation of the truth concerning himself; and of the truth concerning his works: but the creation concerning which we now speak, as the only part of the universe concerning which anything precise or in detail is revealed to us, as an object presented to our faith, is this world: through faith we understand that the worlds were framed by the word of God, so that things which are seen were not made of things which do appear (Heb. xi.): and from the creation to the final consummation, this visible *cosmos* is regarded as one whole —sustained under its present condition by the same word of God which first called it into being, and brought upon it the first universal judgment by water—the type of the second and final judgment by fire. "By *the word* of God the heavens were of old, and the earth standing out of the water and in the water: *whereby* the world that then was, being overflowed with water, perished: but the heavens and earth which are now, by *the same word*, are kept in store, reserved unto fire against the day of judgment, and perdition of ungodly men" (2 Pet. iii.) The deluge, like the creation, and the last day, was a preternatural act—produced by no natural causes, but by the word of God—and it is the privilege of the believer to acknowledge the same Almighty being, continually sustaining that goodly world which he created, and hath once destroyed for the sin of man, and

which he shall once more visit for the destruction of all the evil which hath been brought upon it by sin; that, like *the fabled phœnix*, it may emerge more glorious, more beautiful than ever, and stand the everlasting monument of the wisdom, power, grace, and mercy of God, not only to the glorified saints, but also to the angelic hosts.

St. Peter, in the passage just referred to, speaks with great precision, calling the present system, as a whole, "all things continuing as from the beginning of the creation" (ver. 4); meaning thereby the heavens as they appear to us, and the earth standing out of the water and in the water, by a constitution of these elements having the same reference to each other which they bear at the present time—that is, it is not according to nature—not according to the laws of gravity—that there should be any dry land at all, either before the flood, or after that event; yet the land has been raised out of the water, though earth is much heavier than water; and it has been in both cases by the word of God, as we find it written in Genesis:—"And God said, Let the waters under the heaven be gathered together unto one place, and let the dry land appear; and it was so." Then, by the same word, "the world that then was, being overflowed with water, perished" (6): for God said, "Behold I, even I, do bring a flood of waters upon the earth, to destroy all flesh" (Gen vi.

17): and the *world* spoken of by St. Peter is the *cosmos* (κοσμος)—the adorned surface of the earth with its inhabitants: "but the heavens and the earth which now are"—which is the same constitution of things as a system, and is the all things that continue from the beginning of creation of ver. 4—"by the same word are kept in store against the day of judgment" (ver. 7): for God spake unto Noah, saying, "I will establish my covenant with you; neither shall all flesh be cut off any more by the waters of a flood; neither shall there any more be a flood to destroy to earth" (Gen. ix. 11).

But there is another word, translated world, which has a very different meaning from *cosmos* (κοσμος)—namely, *aion* (αιων), signifying dispensation, or *age*. This is the word used in the epistle to the Hebrews, where Christ is declared to be the appointed heir of all things, and the Creator through whom the Father made the worlds, or constituted the *aions* (αιωνας)—ages, or dispensations. Christ was the word: he also was the wisdom of Proverbs, with the Father from all eternity, contemplating the end from the beginning; and "he gave to the sea his decree, that the waters should not pass his commandment: when he appointed the foundations of the earth:" and he rejoiced from the beginning "in the habitable parts of his earth, and his delights were with the sons of men" (viii. 29, 31). This is the meaning of the language

of St. Paul, in calling Christ the image of the invisible God—*the first born of every creature:* for by him were all things created. It means that the mind and purpose of God was brought into manifestation by Jesus Christ—first, and principally, in his own person; but, secondly, and still more comprehensibly to finite intelligence, through *the creation*, and that which shall be the fullest exponent of creation—*the Church*. Therefore it is added, "all things were created by him, and *for him:* and he is *before* all things, and by him all things consist: and he is the head of *the body—the Church*, who is the beginning, the first born from the dead, that in all things, or as it is in the margin *among* all things, he might have the pre-eminence" (Col. i. 15, 18).

Now Christ made the worlds, or constituted the ages, during which the mystery of God should be developed, as well as created the materials by means of which the mystery should have its visible manifestation: the matter was called into being, and the times were appointed beforehand for accomplishing those stages of development which belonged to the several dispensations—Patriarchal, Mosaic, and Christian, all leading on to the final or resurrection dispensation of the glorified Church, under Christ himself as the head. It is in this specific and precise sense that all things were created by Christ, and for him; and all are thus prophetic of this grand final consummation. And not

only as a whole, and in this general sense, was the creation prophetic, but in all its details—each act is prophetic of another act, further in advance, and so leading onward to the final result. The creation of mere matter is a promise of something more—is a promise of life about to be manifested: for the herbs, and grain, and fruits are provisions for the sustenance of life; and the higher forms of vegetable and the lower forms of animal life almost touch each other, and the insect tribes aid in the fructification of trees in the very act by which they extract the honey from the fragrant blossoms. The animals which form the second act of creation, in their variety of conformation, lead up to man; and, in their instincts, give more and more distinct promises of reason—the characteristic of man, the subject of the last act of creation, which brought the God-like creature into being; not only the head of creation in being to all other created things at once their interpreter and their crown—but God-like in being that predestinated form which Christ, the Creator, would, in the fulness of time, assume—therein to become head of the Church and visible lord of the universe—of which the dominion given at first to Adam was the type.

There cannot be a doubt in the mind of a believer in Scripture that the animals were created harmless, were free from suffering, and were not designed to prey upon each other:

and this, whether we regard the unequivocal declarations that herbs and fruits were originally appointed to be the food both of animals and of mankind; or whether we refer to subsequent events or prophecies concerning the future condition of things in the renewed earth. During the time that the animals remained in the ark, the carnivorous propensities of the beasts of prey must necessarily have been suspended, or they must have had a very long fast of it: and even after they were let loose from the ark, a few active lions and tigers would not only have destroyed the young of the graminivorous animals faster than they could multiply, but would very speedily exterminate the whole race, and not leave a single defenceless animal upon the face of the earth. Moreover, it is declared in those prophetic Scriptures which treat of the restitution of all things, that the wolf shall dwell with the lamb, and the leopard shall lie down with the kid; and the calf and the young lion and the fatling together; and a little child shall lead them. And the cow and the bear shall feed; their young ones shall lie down together: and the lion shall eat straw like the ox (Isaiah xi. 6-8). We understand these prophecies literally: but if any chose to understand them figuratively, even then they prove our point: for no promise of God involves an absurdity; and if it were impossible that a lion should subsist on straw, like an ox, to promise

such a thing would be a foolish figure, but argues folly in him who makes it a figure—not in the promise itself. In the prophecy, understood in either way, it is equally implied that lions can live on straw like oxen—that there is no physical impossibility, no absurdity in the supposition—and, moreover, that it is a good thing that they should live upon straw, and not upon blood. We believe that they did so at the beginning, when God pronounced over all things that they were very good: we believe that they shall again do so when the Lord cometh, and when none—nothing whatever—shall hurt or destroy for the time to come. It is the promise of a restoration to a primæval constitution of things, better than that at present subsisting, and never again to be lost or forfeited. At the beginning God said, "Behold, I have given you every herb bearing seed, which is upon the face of all the earth, and every tree in which is the fruit of a tree yielding seed; to you it shall be for meat. And to every beast of the earth, and to every fowl of the air, and to everything that creepeth upon the earth, wherein there is life, I have given every green herb for meat." No words can be plainer than these: they can only be set aside by disbelieving divine revelation, both as to this first constitution of things, and as to the prophecies concerning the new creation, or the restitution of all things.

These theological arguments, which are both strong in themselves and altogether positive in their bearing, we state thus fully in justification of our rejection of the geological hypothesis concerning extinct species of predatory animals which existed before the creation of man—an hypothesis which rests at most on the mere *negative* evidence of our not having yet discovered any traces of man in similar strata. This inference, from the mere absence of human remains, may be any day refuted by the discovery of human implements imbedded in rock; and a letter now lies before us in which we are assured that forged pieces of iron and brass have been found imbedded six feet below the surface, in the unfractured, undisturbed, horizontal layers of lias, which are worked in the neighbourhood of Glastonbury. We are afraid of laying too much stress on a single fact; but a single fact like this, if it can be established beyond all contradiction, would certainly suffice to refute all the speculations which only rest on the absence of such a fact.

And with respect to the other part of the hypothesis, which assumes that all strata are sedimentary deposits—and that, therefore, it would require ages of incalculable extent to accumulate materials sufficient to form deposits so numerous and of such great thickness—this branch of the geological argument we have considered in all its bearings in several former

articles, and have endeavoured to show that it is without support as to facts, and is contrary to all known principles, natural or physical.

But, for the convenience of our readers, we give a brief summary of the arguments and the answers, and will use as much as possible the words of the geologists, that we may not misrepresent their arguments. One of them writes thus:—"The geologists conclude that the surface of the earth has reached its present condition as the last of many changes, during which its various parts have been successively dry land and immersed in water. The strata (say they) must have been formed at the bottom of seas, estuaries, and lakes, by the sediment deposited by rivers, currents, and other causes; while the calcareous formations appear to have been derived, in part, from the labours of marine animals, which formed beds similar to the coral reefs of tropical seas; and the coal from growths resembling peat-bogs, but of superior vegetation; or, some suppose, from drift plants and timber."

Here are three classes of products—first, sedimentary deposits; secondly, coral reefs; thirdly, coal from vegetation. For the first assertion, that the strata must have been formed at the bottom of seas and lakes, we might meet it with a contrary assertion, and wait for the proof, since the *onus* lies upon them, and not upon those who deny in the absence of proof.

But we say that it is incredible to any attentive observer—that there is no conceivable possibility of these strata having been formed by sedimentary deposits, under any known laws, or by any existing agency. The structure of the rocks themselves refutes such an origin; and their homogeniety, as distinct formations, on the one hand, and their distinctness from each other, when two formations are compared, on the other hand, negative the idea of their all being derived from one source, or being formed by a similar process. But it is granted by the geologists themselves that no instance has occurred, since the creation of man, of a single stratum having been formed by sedimentary deposit: therefore we may legitimately deny that strata could ever be formed by the only laws we know—the laws at present in operation. If, in the course of six thousand years, not a single instance of such an effect can be produced, it is not reasonable to expect us at once to concede the point assumed, that all those enormous masses of strata have been formed by means which are, at the present time, confessedly inadequate.

One of the ablest as well as one of the most recent works on geology contains the following passage:—"It is, perhaps, an unfortunate circumstance for geology that, in whatever way the subject is at first viewed, it is surrounded with difficulties, arising from the impossibility of actually connecting geological phenomena

with the operations now going on around us. If, for instance, we endeavour to trace back the history of the world, and pass from the alluvial matter carried down by rivers to that of the gravel, which appears to be the newest deposit, and one abundantly spread over various formations, we are at once struck with the utter inadequacy of any cause now in action to produce such effects." This *impossibility* of accounting for the facts by any operations now going on—this *inadequacy* of the assigned causes to produce the known effects—is the gist of all our arguments, and we are glad to have them confirmed by so high an authority as the professor of King's College.

The second class of products mentioned are the calcareous, supposed to be produced in the same way as the coral reefs of tropical seas. In considering this great deposit, we must remember how very large and wide-spreading a formation it is; being estimated as covering one-eighth part of the surface of the earth to a depth of several hundred feet. Were the *tropical* seas ever of this extent? The chalk runs through the heart of France and the centre of England—what ground is there for saying that these countries were ever within the tropics? It is imagined that the calcareous matter has been derived from the labours of marine animals, because it is impossible to derive sufficient materials from the decomposition of the older rocks; as granite, old

red sandstone, &c., contain very small proportions of lime, and very large proportions of other ingredients which are found only in minute quantities in the chalk. And the supposing that it could be formed *originally* in the same manner as it is formed by marine animals, in the shape of coral, is a false analogy; for lime is not *created* by these animals—they only *collect* it from the sea, into which it has been washed down from the calcareous strata *already in existence*; and these animals would not be able to form the coral, but that the sea holds in solution large quantities of lime, which these creatures take up. No animal has power to *create* matter—it only appropriates that which is brought within its reach. Birds are very fond of egg-shells, because these furnish the lime which their own egg-shells require; and if hens are kept in places where they have no access to lime, all the eggs that they lay will be destitute of shells and quite soft.

The question is not how calcareous matter, already existing in another form, may become chalk; or how, if suspended in water, it may be taken up by corals or precipitated and consolidated: but the question is, how such enormous quantities of calcareous matter came into existence, since it cannot be derived from the older rocks. As Dr. Buckland has well expressed it in his "Bridgewater Treatise:"—

"It is a difficult problem to account for the

enormous masses of carbonate of lime that compose nearly one-eighth part of the superficial crust of the globe. Some have referred it to the secretions of marine animals—an origin to which we must obviously assign those portions of calcareous strata which are composed of comminuted shells and coralines; but, until it can be shewn that these animals have the power *of forming lime from other elements*, we must suppose that they derived it from the sea, either directly or through the medium of its plants. In either case, it remains to find the source whence the sea obtained, not only these supplies of carbonate of lime for its animal inhabitants, but also the still larger quantities of the same substance that have been precipitated in the form of calcareous strata. We cannot suppose it to have resulted, like sands and clay, from the mechanical detritus of rocks of the granitic series, because the quantity of lime these rocks contain bears no proportion to its large amount among the derivative rocks. The only remaining *hypothesis* seems to be, that lime was continually introduced to lakes and seas by water that had percolated rocks, through which calcareous earth was disseminated."

Another mere hypothesis!—to account for the failure of a preceding hypothesis; for these supposed lime rocks no where exist—and it is facts that we require, and not hypothesis after hypothesis.

The coal formations we may dismiss with the remark, that though they are local, and independent of each other, they usually consist of immense accumulations in those localities; sometimes amounting to thirty or forty beds, each of which would require more vegetable matter to form it than could ever, by any possibility, have grown in that locality; while between the beds, and over them, are solid strata of stone, which bring the coal formation itself, by this close association, under all the objections to a sedimentary deposit, which we have already alluded to, under the first head, as involving impossibilities.

To give some idea of the time it would require, we quote an observation of one of the most eminent of geologists:—"On our way home ... ... I observed a thin black line of charred vegetable matter exposed in the perpendicular section of the bank ..... As geologists we may learn from this fact, how a thin seam of vegetable matter, an inch or two thick, is often the only monument to be looked for of an ancient surface of dry land, on which a luxuriant forest may have grown for thousands of years." If to form an inch or two of deposit thousands of years were required, our readers may calculate how long it will take to form thirty or forty beds, from three to six feet in thickness, or perhaps they may think the time incalculable.

Thus, all the main points of the geological

hypothesis, concerning the origin and formation of mountain masses, appear to be erroneous; and, by the acknowledgment of the geologists themselves, the facts are insufficient to sustain their assertions—are inadequate to explain the existing phenomena. Is it not then the part of wisdom—nay, even of common sense, to pause? Should we not wait for more facts, or for a better explanation of the causes of phenomena already observed?

And as the scriptural narrative, by its simplicity and consistency, affords the best means of detecting the error, and is a clue to guide us through the mazes of such a labyrinth, would it not be wise at once to abandon speculation and hypothesis, and resolve to acknowledge only the facts of revelation for our principles; and, on this basis, construct and arrange our explanation of those facts of geology, which we may collect or infer from the present condition of the things around us?

The facts of revelation consist of two great classes: those concerning creation, or the origin of all things—and those concerning the deluge, by which the original constitution of the earth was entirely altered, and it was brought into its present condition. The fundamental error of the geologists consists in supposing that the earth could have come into its present condition by natural agency—that is, by causes or properties of matter which are in operation at

this time. We deny that any such causes could produce any such effects, and their inadequacy is virtually conceded by the geologists themselves: but they have also mistaken the facts of the deluge, and have supposed that this mighty catastrophe was brought about by natural agency —in short, that it was a flood produced only by heavy rains, though universal. We have shown that this would be an impossibility, and the Scripture always speaks of the deluge as supernatural, and without a parallel. They have also mistaken the facts of creation, and treated them as though all we could know about it were accomplished by natural agency; and they have thrown back creation proper into a region so inconceivably distant and obscure as never at all to enter into any of their contemplations, and it may, in this sense, be said, that God is not in all their thoughts: thus it is not to be wondered at that they have found no place in their system for the scriptural facts of the creation or the deluge, which, in the Mosaic narrative, are both ascribed to the immediate hand of God.

What we mean by SCRIPTURAL GEOLOGY is, that the Christian should regard God's word and his works as one whole, and only as different modes of recording the same history—the end and purpose of the whole being to make himself known. Christ began his instructions in such a manner—teaching the disciples, in

his first discourse, that God had clothed the earth, and that he feeds the ravens, and that not a sparrow falleth to the ground without divine permission: yea, that the very hairs of our head are all numbered. Much more, then, in contemplating the CREATION of the heavens and the earth, and in considering how all things came into their present state of acknowledged disorder and suffering: much more in looking at the evil side of the picture which the world presents, we should ever so keep God in our thoughts as to prevent the folly of man from charging causeless evil upon God. And where evil cannot but be acknowledged, trace it to the sin of man; which rendered it necessary to the holiness of God, who cannot connive at sin, to allow of corresponding punishment and reluctantly take in hand his long forborne and strange work of judgment against those who refuse to repent, and persist in provoking the wrath of the Most High.

It may be that the time is not yet come for setting geology on its true basis, for it is a very recent branch of science; its commencement falls within our memory, and no science we believe is matured in a single generation. And the first work to be done for effectual progress in any science is that of the pioneer, clearing away obstructions from the path; the first care of a judicious architect is to remove all accidental accumulations, and lay a solid foundation.

Much will be done towards future progress when all unfounded hypotheses are swept away: and the trust-worthiness of the future building would be ensured by laying it on a scriptural basis. If this were done, it would be of little consequence whether the work proceeded fast or slow: however slow it would be sure, and the work done would abide; while at present all is left to the mere ingenuity of men, and almost every year we are amused or shocked with some new hypothesis, varying only according to the good or bad taste, the caution or the recklessness, of the propounders.

## CHAPTER VII.

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THE ANCIENT WORLD; OR, PICTURESQUE SKETCHES OF CREATION: BY D. T. ANSTED, M.A., F.R.S., F.G.S., PROFESSOR OF GEOLOGY IN KING'S COLLEGE, LONDON.

IN a book with such a title as this, perhaps, we ought not to expect anything very accurate—anything which has cost the writer much time or trouble—anything by which science may be advanced, or which those who are scientific will ever look at; but that it is rather like the dashing sketches of a young lady, which, however picturesque they may be, make no pretensions to accuracy; or, like a portfolio which we once saw, humorously entitled "Fugitive Sketches," some of which were taken from the top of a mail coach when travelling at full speed. But when a man of science puts his name to a book it will inevitably be brought into comparison with his former self—it will be expected to add to the reputation which he has already acquired—and, if it fail in this, it will surely detract from even his former fame. Every eminent man should be aware that whatever he does is noted; works worthy of his name are looked for; and he must take care that he does not disappoint

these expectations: the world is envious and capricious—science is jealous over the conduct of her sons—he should not tempt men to question whether the reputation he has enjoyed be legitimately acquired, and does, in fact, rest upon a true and solid foundation.

We do not like the title of this book—"Picturesque Sketches of Creation." Creation is too sacred a word—too much associated in our minds with the Creator to stand well in such a connection; and picturesque sketches lead one to expect loose inaccurate descriptions, dashed off for effect, to please or astonish vulgar minds, without any care, or thought, or effort. It savours too much of hap-hazard and quackery to be in strict keeping with a professor of King's College, or to be in harmony with the works already published by the author. And, although it can scarcely happen that anything proceeding from Professor Ansted's pen will descend to the level of an ephemeral production and live only its single season, yet we are convinced that this volume will not add at all to the reputation of its author, and will be more speedily forgotten than any of his former publications.

And regarded merely as a printed book, there is too much external pretension about the appearance of this volume, and too little substantial reality, to be in correct taste: its covers are splendid—solid wooden boards, got up in

crimson and gold, with the inscription and the author's cypher in antique characters—leading us to expect correspondent paper and type, with elaborate, if not splendid, illustrations. We expect leaves of vellum, or thick paper of a mellow tone, and suitable pictorial decorations to pages of a full-bodied massive fount of letters of venerable appearance; but we find, on the contrary, a thin, cold, bluish paper, and the wiry hair-line type of modern times; and the illustrations are of the most paltry and meagre description possible—they are mere outlines and that without spirit—most feebly and indifferently executed. There is actually only one good engraving in the volume, and that merely the pod of a Mimosa (p. 270); the rest are poor scrawls, as may be rendered evident in the Mylodon (p. 369), compared with the skeleton of the same animal which is engraved in Ansted's "Geology" (vol. ii. p. 156).

On examining the contents of the volume we are not much better satisfied with its matter than we have been with its external appearance. There is a looseness which amounts to a desertion of the commanding station, which, from an extensive yet accurate survey of its domain, gives dignity to true science. The man of science will pledge himself to everything he asserts, and pledges himself to nothing which has not been rigidly and incontrovertibly demonstrated; nor will he insinuate anything by which he is not

prepared to stand. There is such a thing as the throwing out of opinions, which, being those of a professor, carry with them an official weight, though they may be after all only the opinions of an individual, and to which even he cannot pledge himself, because they are mere opinions and are not borne out by the facts. Things are stated hypothetically, which the great majority of ordinary readers will understand as authoritatively and dogmatically laid down—many, because they perceive not the difference—many, because they feel that the opinions of a professor are to them always of the nature of dogmas: for few have the means, and fewer still the inclination, to examine for themselves into the degree of weight which ought to be attached to the opinions that have been hazarded on the subject of geology and the ancient world.

The second chapter of this work begins in the following words:—

"Judging from the general appearance of the solar system, and combining the result of astronomical observations on distant bodies in the universe with the appearance presented by various rocks on the earth's surface, it seems not unlikely that, at a very early period of its history, our globe existed as an intensely heated body in a fluid state (the fluidity being the result of igneous fusion), and that it cooled gradually at the surface, perhaps by exposure in space, contracting in dimensions as it cooled and

hardened. In this manner, it may be, a succession of thin solid crusts were formed, each in succession shrinking and cracking, until at length, when a certain balance was arrived at between the thickness of the crust, the rate of cooling, and the amount of internal heat, there would be left a rough uneven surface, having many elevations and depressions, its temperature being sufficiently reduced to allow of the existence of some such atmosphere as now surrounds it, and also permit the permanent presence of water in a fluid state reposing in the hollows and forming seas, lakes, and oceans."

And, after stating what are the rocks to which this account of the world's first condition is meant to apply—viz., those which are decidedly crystalline like granite, and those which are destitute of organic remains; and, after making large deductions from these of such granites as present signs of stratification, and such semi-crystalline rocks as are called metamorphic, the chapter concludes as follows:—

"It must, however, be distinctly understood that this view is strictly hypothetical, and is, after all, only one means of explaining certain phenomena. So far as it is an illustration of facts that have been observed it has its value, and may be received provisionally: but so far as it is merely a theory of the earth, it is worth neither more nor less than other different theories, many of which were proposed by cosmogo-

nists of ancient date, and some have been put forth in our own time by persons who have as little ground for theorizing. I have chosen, in the present case, to present it as a sketch, embodying many facts and results of observation, although the cause of the absence of fossils in metamorphic rocks, and of the other appearances that have been observed, may undoubtedly have been very different" (p. 21).

We accept this account of the hypothesis contained in this volume, and which is that at present most in vogue: "it is worth neither more nor less than other different theories," except as it succeeds or fails in explaining consistently and intelligibly a greater number "of facts that have been observed." And our only objection to the modern theory is that it is contrary to observed facts, and so is worth less than the former theories, which were in agreement with such facts as had come to light at the time when they were constructed, or were broached as pure speculation without claiming the support of facts: but the modern theory claims, with the utmost confidence, the support of facts, and boasts that it is derived solely from the more enlarged science and more accurate observations of modern times; and yet it is contrary to all true principles of science, and will not bear a careful comparison with well known facts. The theory professes to be "only one means of explaining certain phenomena." All ordinary

readers will conclude that it *does so*, and will take it for more than it is worth: for, when examined closely, it is not "an illustration of facts that have been observed;" and is not, therefore, of equal value with many of the other theories, which, though defective, were in agreement with the facts which were at that time known, and were, of necessity, imperfect, because fewer observations had been made, and were made by less scientific observers.

Our chief difficulty in exposing the errors of the modern hypothesis results from the vagueness which pervades all its statements: we cannot get a firm hold of it—none of its affirmations are positive—they are only "not unlikely," and are qualified by a "may be," or a "perhaps:" so that the moment we touch them they crumble or shift their ground, and so elude our grasp. When we think that fire is the element introduced, straightway it becomes water; when stratified rocks are apparently before us, the magic word is given, and lo, they become metamorphic! Thus, in the statement which we have just quoted, and on which all the following statements depend, we are told that, judging from astronomical observations, "*it seems not unlikely*" that our globe was originally an intensely heated body in a fluid state; that it gradually cooled, "*perhaps* by exposure in space:" in this manner, "*it may be*, a succession of thin solid crusts were formed;" and its temperature

"*being sufficiently reduced,*" the present or *some such atmosphere* was generated, and it would "also permit *the permanent presence of water;*" "during the whole of this time, and *perhaps long afterwards, it is likely* that there were no living beings on the earth," &c. (15, 16). Each one of these statements is erroneous: we desire to refute each one of them in detail; when, after having done so, we may be told that they were only stated as likelihoods and probabilities, and that *the geological facts* remain untouched; and it is held vain for us to reply that it is *not the facts*, but *the hypothesis* apart from the facts, that we are combatting. Now the hypothesis rests *solely* on these *likelihoods*, and we want to show that all these statements are *unlikely*, some of them are contrary to the principles of science, some self-contradictory, and therefore absurd.

This hypothesis is, in fact, the nebular theory, which, professing to rest on "the general appearance of the solar system," assumes that nebulæ are stars uncondensed into solid masses, and that their hazy undefined appearance is owing to the matter of which they consisted not being yet consolidated into suns and planets, and that they are systems in embryo which will in due time become regular, like our own. The nebulæ had appeared thus hazy under the most powerful telescopes that had been constructed in former times—even under that of Herschell, who himself warmly advocated, if he did not

invent, the nebular theory. But the theory was gratuitous even then, because we had no evidence that these nebulæ were undergoing any change—no proof that they ever would condense: they were not in a state of transition—no alteration was perceptible by the instruments then in use. Since the construction, however, of Lord Rosse's splendid telescope, the case has been wholly altered: it is now *proved* that the nebulæ, on which the most reliance had been placed in constructing the theory, are not so many halos of diffused or unconcentrated light; but that they are clusters of stars, each one of which is as distinct and separate as any other star; but, being all at a distance enormously remote, they are brought together by perspective and rendered *hazy in appearance*, though they are *in fact* as bright and as compact as stars of the first magnitude. It is not creditable to the understanding of any man who is acquainted with Lord Rosse's discoveries to persist in maintaining the nebular theory NOW.

Then, again, it is necessary, for maintaining the geological hypothesis, to assume that the other bodies of the universe are *similar* in constitution to *our own globe;* and especially that the planets of our solar system consist of earth and water and an atmosphere, each substantially agreeing with our own earth, water, and atmosphere; for, if there be no analogy, there can be no inference. But they are not analogous

—they are not similar: so far as we know them they are dissimilar; the moon, which is nearest, is very different, and the belts of Jupiter and the ring of Saturn prove that these distant planets are altogether *unlike* our own in substance and arrangement. Moreover, all the planets, without exception, are destitute of any *perceptible atmosphere*, consequently are destitute of *water*, and could not support animal or vegetable life without these necessary elements.

The late Dr. Woolaston was one of the most accurate observers—one of the closest reasoners of modern times; and, with the view of determining whether matter was only finitely divisible, he conducted a series of experiments on a transit of Venus, which proved, first, that the atmosphere of our earth is limited—that is, there is no perceptible atmosphere whatever beyond a certain distance from the earth's surface; and proved, secondly, that the other planets of our system have no atmosphere whatever. It would be unphilosophical to say that there may be an atmosphere although Woolaston was unable to perceive it: there may be men in the moon, but we cannot form a conception of their mode of life without those elements of air and water which we find necessary for all living things; so if an analogy is to be drawn from "the solar system, and distant bodies in the universe," to account for "the appearance presented by various rocks on the earth's surface,"

and "some such atmosphere as now surrounds it," and "the permanent presence of water in a fluid state," we require to be shown that these "distant bodies of the solar system" do consist of earth, air, and water; whereas, Woolaston has shown, on the contrary, that they have no atmosphere, and therefore no water; and, so far as we can judge from appearance, no such earth as ours—certainly nothing at all like "the various rocks on the earth's surface."

Woolaston's paper was published in 1822; and, although it was based on his own observations of a transit which had recently occurred, he shows that the same inference might have been drawn as early as the first discovery of the telescope, or Galileo's observations of the eclipses of Jupiter's moons; for, if there were an atmosphere around Jupiter himself or around his satellites, the disappearance and reappearance in eclipses would not be instantaneous as it is; and if there were an atmosphere of the same refractive power as our own, the fourth of Jupiter's moons would never be eclipsed at all, but would remain visible when at the very back of the planet.

The limited extent of our atmosphere being demonstrated, the idea of the earth having cooled "by exposure in space" is also demolished thereby; and, consequently, the "succession of thin solid crusts" formed in cooling. In truth, these *thin crusts* never had any analogy or any

probability on which they might plausibly rest, being only a sort of loop-hole for evading the defence of stratification, and even of the metamorphic position, when hard pressed by an objector; and serving as a last resort of the desperate defenders of untenable propositions which have been too confidently advanced, and which men cannot, without seeming disgrace, abandon. Even although the finite extent of our atmosphere had not been proved, it would be beyond reasonable credibility to suppose that all the water at present existing could have found space for itself in the form of vapour, and its existence in any other form seems impossible. All the suppositions seem to create far greater difficulties than those in order to remove which they have been invented.

Whenever Professor Ansted confines himself to the safe province of facts he is as instructive as in his former work, and on this ground we always meet him with pleasure. He divides the geological series of rocks into three epochs—ancient, middle, and modern; subdividing each of these into three periods, marked by characteristic differences among the fossils contained in the several strata belonging to these periods, and preceded by a period during which those rocks alone were in existence, in which no imbedded fossils are found. Differing from Professor Ansted concerning the causes of this order of things, and concerning the time at which this

arrangement took place, we entirely agree with the classification, and division into groups, which are here proposed; for there are manifestly natural breaks at the termination of the carboniferous deposit which forms the last period of the said "ancient epoch; and also at the termination of the chalk deposit, the last period of the "middle epoch." But we think that the absence of fossils is so marked a feature, that those rocks which are void of them should have constituted a class by themselves; and, instead of regarding granite and such rocks as forming the first period only of the ancient epoch, we would prefer placing them together, as belonging to the primitive epoch, and distinct from all other deposits. In the primitive rocks there is not only this marked distinction of the absence of all traces of organic life, but they are also more highly crystalline in their structure and unstratified in their formation; and, above all, it is to be noted that a natural break occurs here, as in the other divisions, accompanied by extraordinary upheavings and convulsions of the earth's surface, marking a distinct epoch at this stage, as at the two other stages, where a line of separation has been drawn. Werner, and all geologists who have endeavoured to form a natural system, have separated the primitive from all other rocks, because they found between them well pronounced distinctions of character; and when stratification and animal

remains became elements of classification, two additional distinctions and two other reasons for separation were introduced thereby; and on every account the primitive rocks should form one class.

The only objection to treating the primitive as a separate class of rocks, which occurs to us, is an objection arising solely out of the geological theory. With that theory a succession of crystalline rocks will not coincide; and, as mechanical deposition from water in which the particles had been held in solution is the only account of stratification which this theory admits, and all the reasoning proceeds on such an assumption, every effort is used to diminish the number of truly crystalline formations by regarding all as volcanic which occur in masses, or present but slight indications of order and regularity in their structure; and by naming others metamorphic, as though crystallised by the subsequent agency of heat or galvanism, when indisputable marks of stratification and order are observable in crystallized rocks.

Professor Ansted appears to regard granite as the only primitive rock, and to regard all dubious granites, together with gneiss, mica-schist, clay slate, &c., though no trace of fossils may appear in them, as of mechanical structure, and deposited from water; which deposits, "by passing a galvanic current through them would, in time, become mica-schist" or clay slate, as

the case may be—that is, they would thus be metamorphosed, and the mechanical deposit would become crystalline in its structure. We give this as we find it, but do not believe one iota of the metamorphic hypothesis; taking the liberty which the author gives us of thinking it "worth neither more nor less than other different theories proposed by cosmogonists of ancient date"—that is, worth nothing at all as science, and worth very little as a speculation, and not at all facilitating classification or arrangement.

These fundamental or primitive rocks, which may be regarded as forming the skeleton of the earth, and of which the principal masses in all great mountainous districts consist, are dismissed in a very cursory manner in the volume before us, having only five pages devoted to them all—not quite two pages to the granitic rocks, and only three to gneiss, mica-schist, and clay slate, and no mention being made of any other of the primary rocks; yet, as in this brief chapter some of the most objectionable passages in the work are to be found, it is right that we should give a few extracts. "The first period of the existence of the earth as a planet was marked by a chaotic state of igneous fusion, and characterized by frequent disturbances of the surface consequent upon cooling from such a state:" on which it is palpably obvious that, as no cause is assigned either for the heating or cooling of

the earth, the supposition is a pure gratuitous assumption; for it derives no support from astronomy, as we have already shown: and even supposing the earth to have been a heated mass, and to have gradually cooled, it is obvious that there would be no disturbances on its surface: for these are always occasioned by some partial and local variations of temperature—no heated mass whatever if gradually cooled, and cooled in all parts alike, would crack or fly in the cooling—all its parts would expand equally or shrink equally—there would be no disturbance consequent upon cooling:—

"In the first place we often find, as the basis of all other rocks in mountain chains, and throughout some extensive tracts of the country, a well known rock called *granite*—a rock whose structure is crystalline, and which bears strong marks of having cooled slowly from a state of intense heat..... It must not, however, be lost sight of, that in many cases the granite has been, if not formed, at least placed in its present position in a pasty or fluid state (in either case the result of intense heat acting under enormous pressure), long subsequent to the early period of which we are now speaking; and thus, though we may safely consider the granite as frequently the oldest rock, we should always remember that a material so widely extended and so important may be elaborated and expelled from the deep recesses of nature's store-house at any time, and even at the present day" (17).

Here we are all at sea and left without chart or compass: if granite be at once the oldest and newest of rocks!—be the basis of all other rocks, and yet may be elaborated at any time, even at the present day!—calling granite a material so widely extended and so important is beside the question—we throw it aside as surplusage. The question is whether the agency to which the formation of granite is ascribed be in active operation at the present day. The agency assumed is intense heat—such heat as reduced the earth to a melted mass—and would not "allow of the existence of an atmosphere"—would not "permit the permanent presence of water;" and does any such agency exist "at the present day?" We will not be put off with a "may be," or by an appeal to the deep recesses of nature's store-house, of which we know nothing, and the geologists know no more. We say one of the two positions must be given up—either the granite was not formed by that intense heat which reduced the earth to a fluid mass; or, if it were so, no granite is formed at the present day, because the earth is not so heated: both these positions cannot possibly be true, but it is very possible for them both to be false. Lavas, which have probably suggested the idea, and which are the only known products of the deep recesses of the earth, present but a faint and a very remote analogy; for they are of every variety both in composition and con-

sistency, even in the same district and from the same eruption; and they are always accompanied with glass, tufa, pummice, and other indubitable evidences of a volcanic origin, totally unlike that well characterized rock which we call granite, which is constant in its main ingredients, though the proportions of these may vary, and it is sometimes debased by hornblende; and which has no other accidental or foreign ingredients like those which make up the chief bulk in all lavas; and, moreover, we demand a proof of the assertion—*show us a granite which has been formed at the present day*:—

"Next in order to the crystalline rocks, and almost as widely extended, there are two or three others, often themselves crystalline, but bearing evident marks of what is called 'mechanical structure,' or in other words, of having been deposited from water. These may be described as gneiss, mica-schist, and clay slate..... deposited in layers, which, by passing a galvanic current through them, would in time become mica-schist. These three mechanically-arranged rocks are found abundantly, surrounding and overlying the granite. In these rocks we have arrived at a second period, still unmarked by life, although apparently better fitted for sustaining it, our earth being then not merely a chaotic mass of cracked and burnt rock, but having had superimposed upon that mass extensive and thick layers of various materials" (19.)

These are the *metamorphic* rocks of the modern nomenclature, supposed to be changed by the long continued action of *a galvanic current* passing through the beds after those beds had been *superimposed* upon the granitic mass in *extensive and thick layers;* all of which operations presume, or rather necessitate, enormously lengthened periods of time first to deposit, then to metamorphose, each layer; and the sum of all these enormous periods bewilders thought and baffles all calculation; but, when we come to examine it, the absurdity of the hypothesis at once appears in the contradictions which it involves. The semi-crystalline structure of the metamorphic rocks is ascribed to a galvanic current; but the crystalline structure of granite is not ascribed to a more powerful galvanic current operating for a greater length of time, but to a totally different agency—to intense heat; so intense as to reduce the whole globe to a "pasty or fluid state," during the continuance of which neither water nor the present atmosphere could exist, and this "chaotic mass of cracked and burnt rock" "cooled slowly" to the present temperature of the earth, so as to allow of the deposition of the metamorphic and other rocks; such a *moderate* heat as is compatible with the existence of *water* being absolutely necessary for explaining the origin of these latter rocks, while such an intense heat as is *inconsistent with the existence of water* was deemed necessary for ex-

plaining the origin of the former. And yet we are told in the same breath that the former, the crystalline, "may be elaborated at any time, and even at the present day!" Why, then, all this parade of intense heat and countless ages? And why call the metamorphic rocks "next in order," and point to their vast thickness and immense extent as proofs of the length of time which has elapsed since the formation of granite, if it is still in process of formation? The metamorphic changes supposed to be wrought by galvanism on strata, which had already attained such a degree of consolidation as to be distinct from each other, we altogether disbelieve; and even this supposition is found insufficient to meet the facts: wherefore it is said, "we can hardly suppose the existence of depressions so considerable as the thickness of the gneiss and clay slate would require; and it is far more reasonable to assume that a contraction of the crust, the result of gradual cooling, produced a series of wave-like motions in the earth's crust, alternately elevating and depressing portions of the surface, and sometimes producing a succession of elevations or depressions on the same spot." To our taste it would be far more reasonable to say nothing at all about it than to write such nonsense as the above. Every tyro knows that it is only when a mass is *not* gradually, but suddenly or partially and irregularly cooled, that such disorders could take place, and every

practical geologist knows that the phenomena which it is thus attempted to explain are too orderly, too grand, and constant to be ascribed to accidental convulsions. To explain them satisfactorily they must be brought under a law. This "chaotic" theory of the primitive rocks we reject altogether.

The third chapter treats of those strata which lie immediately over the primitive rocks, and in which the first fossils—that is, the remains of beings which once had life—begin to appear. These are strata of very great thickness, and the animal remains occur so sparingly that it was long disputed whether they contained any. But there is no longer any doubt on this point, and the marine products thus imbedded prove that these strata were formed in or erupted through the bed of the ocean, and that under great pressure accompanied by violent disturbance, as Professor Ansted well observes:—

"They have been found to exhibit indications of very extensive disturbances, and, in some cases, seem to have been deposited alternately with great masses of igneous rock poured out like lava from a volcano, but erupted through the bed of the ocean, and soon covered up with new deposits. Besides disturbances of this kind, these same rocks have, in North Wales, been subjected to so much squeezing under a great pressure from above that they are twisted into folds repeated several times, just as a number

of pieces of cloth might be thrown into wave-like folds if squeezed by lateral pressure with a heavy weight resting upon the upper surface. No description, however, can at all do justice to the singular complication thus introduced into the huge masses of hard and tough rock. In one place the strata are snapped asunder and displaced; in another they are bent nearly double like sheets of paper. Here the slaty beds are contorted into the most strange and violent curves, there the opposite cliffs of a narrow glen exhibit them torn asunder like fragments of soft wood or semi-tenacious paste" (24).

In this account of the appearance and probable origin of those rocks, in which the first signs of life appear, we feel convinced that Professor Ansted has approached nearer to the true account of the origin of all rocks than in any of his preceding or subsequent speculations. We do not allow that there are alternations of igneous rocks and of aqueous deposits, because we believe that all the rocks of one formation must of necessity have had one and the same origin; but we believe that they were "erupted through the bed of the ocean" on the evidence of the marine remains imbedded in those rocks, and that they were subjected to great pressure from above, and also to great lateral squeezing, on the evidence of the twisting and doubling of the strata. But the strata must have possessed

a considerable degree of tenacity and of ductility to be capable of this: they could not have been in the condition of sedimentary deposits from a mechanical solution—they could not have been gravel, sand and mud, whether wet or dry: they must, in short, have been in a tenacious state resulting from chemical solution of the particles, and not mere deposits of particles not dissolved but only suspended in water. The illustration employed is that of pieces of cloth, and it is because the cloth has tenacity; and, under the pressure and the squeezing, retains the distinctness between fold and fold. Layers of sand or layers of clay would not serve for the illustration, for the former never would have the distinction, and the latter would never retain it under pressure and squeezing: both would alike become, not strata, but one undistinguishable mass. And this viscous or semi-crystalline consistency we claim for all the beds or strata of this formation, and in a higher degree for the older or more perfectly crystalline rocks, and in a lower degree for all the succeeding strata, however little of a crystalline structure they may externally or superficially manifest. We allow, in short, of only one agency in the formation of rocks from the granite to the chalk; and the volcanic products we class by themselves, and regard as accidents and exceptions which ought not to be admitted into any natural order or into any scientific arrangement. And the

proof of a crystalline structure in all rocks we rest upon the fact that all rocks *have a cleavage*, which is constant *in the same kind of rock*, however amorphous some of these rocks may appear.

This cleavage demonstrates an orderly arrangement of the particles of which the rock consists; and this orderly arrangement, we assert, is owing to a lower influence of the same power in a denser medium, which, exercised in a higher degree and in a purer medium, produced crystallization. But even in the lower exercise of the crystallizing power a certain freedom of motion in the particles must be supposed, as, if the strata were consolidated, they could not so arrange themselves; and, therefore, we reject altogether the idea of metamorphosis after the consolidation of the strata, and regard it merely as an expedient to bolster up an untenable theory when facts have been brought to light which that theory had not contemplated, and which could not be brought legitimately within any of its provisions.

Fossils have been loosely called "medals of creation," whereas they are at most only medals of destruction, and only of a small portion of the destruction that has actually taken place. It is in no sense a term which those who are accustomed to affix precise meaning to their words would associate with creation or commencement in any sense, but only with the idea

of death, extinction, termination — this term fossil. At most fossils are the grave of that which once lived, and they ascend not to the commencement of that series of strata in which they are found—far less do they teach us anything concerning its origin. Even the term "medals" is, in this connection, bad; for medals, as records of human history, are of comparatively modern origin. Coins were not struck in Egypt till after the Macedonian conquest, and when all the long line of its national monumental glories had passed away. In Greece and Rome they are not much older, and in Judea they rise not above the age of the Maccabees, and throughout the eastern world were unknown until the reign of Darius, whose gold coins gave the generic name of Darics to money; so that all the earliest and most coveted, because least known, portions of the history of man, receive no illustration from this source. From medals we learn nothing whatever concerning the mighty Assyrian monarchy throughout its whole duration, nor of the rise of any of the other ancient nations; and the vast majority of mankind, even after they had made great progress in civilization, have not left behind them medals whereby we may trace it—some from never having used them, others using such as had no meaning, and none affording information except in proportion as we understand their import and legend, the knowledge and

meaning of which must be acquired from other and purely historical sources.

What does the tortoise of Egina teach us but simply the fact that rude money of that description was current there? The human head is wanting—the legend is wanting; but what man in his senses would infer from the absence of these that men did not then exist, or that writing had not then been discovered? Yet such inferences would be scarcely more absurd than some of those which the geologists have drawn from their supposed "medals of creation." The *rudeness* of the Egina coins is truly a means of tracing the progress of the monetary art and its gradual improvements; and some have been wild enough to imagine a sort of parallel even here, as though the hand of the CREATOR had improved by practice!—as if the first efforts of creation had been rude, or a gradual *improvement* had taken place *in the works of God!* Such persons are really discarding GOD altogether, and are substituting *nature* in the place of GOD; and, doing this habitually, they do it unconsciously—as where in the volume before us it is said of fossils, that "they themselves express the very language of nature; they bear actual, direct, and unquestionable testimony to *the course of nature*.....they exhibit distinct proofs of a long series of *successive creations*, characterizing different epochs in the earth's progress" (9). Is the course of nature a series of

successive creations? We feel assured that Professor Ansted would not deliberately say so; and he expressly cautions his readers "against the premature and unwise attempts that have been made by some authors to explain and bring within the compass of an assumed law of development the obscure and isolated phenomena hitherto observed and apparently bearing on this subject" (382). We could wish that the language had been still more strong, and that he had plainly told his readers that this theory of development is not only premature and unwise, but that it is false, and mischievous, and reprehensible; for the law of development, as it is called, supposes the successive self-elaboration of organized beings, each new form working itself into a higher and more perfect condition than the preceding, and thus rising in the scale of power and capacity for enjoyment: for we are distinctly told in another page of the work before us that the facts are not so:—

"So far as geology, in its present state affords evidence on the subject, the facts seem decidedly opposed to any such view; and I make this statement the more unhesitatingly, because I find that it perfectly accords with the conclusions arrived at by one of the most philosophical of living naturalists, who brings to a close his investigations concerning the extinct reptiles in the following manner:—'Thus, though a general progress may be discerned, the interruptions and

faults, to use a geological phrase, negative the notion that the progression has been the result of self-developing energies adequate to a transmutation of specific characters; but, on the contrary, support the conclusion that the modifications of osteological structure which characterize the extinct reptiles were originally impressed upon them at their creation, and have been neither derived from improvement of a lower nor lost by progressive development into a higher type.' (Professor Owen's Report, 202" —Ansted, 56).

And touching the absence of human remains from those strata where the fossils are found, we remark that if Professor Ansted's idea be correct, as we believe it to be, if strata were "erupted through the bed of the ocean," this would be the situation the least likely of all others to expect remains of man. Before the invention of navigation it would seem scarcely possible that human remains could reach the ocean; and even now, in the thousands of wrecks that take place in our shallow seas, how few of the remains ever appear? And in the hundreds of human beings which went down together in the *Royal George*, and which one would expect to be better preserved by the timbers of the vessel, scarce a vestige of these hundreds was brought to light on breaking up the wreck.

We are sorry to see that Professor Ansted is led away by the false reasoning of Dr. Buckland,

and gives his countenance to the idea that it would be abstractly and *d priori* a good thing that animals should have been doomed at their creation to prey on each other. He draws a picture of an amiable shark engaged in its lawful occupation of getting a dinner by devouring as many smaller fishes as it can catch; and, resting in its good work to digest the meal, a plesiosaurus pounces upon the shark and makes good work of him in a trice; while, in the deeper recesses of the ocean, watching these interesting operations on the surface, and prepared to seize the proper moment, prowls the benevolent ichthyosaurus, which, as soon as the plesiosaurus is a little off its guard, "darts through the water, at a rate which the eye can scarcely follow, to the surface. The vast jaws, lined with formidable rows of teeth, soon open wide to their full extent—the object of attack is approached—is overtaken. With a motion quicker than thought the jaws are snapped together, and the work is done. The monster, becoming gorged, floats languidly near the surface with a portion of the top of its head and its nostrils visible, like an island covered with black mud upon the water" (181). And this, it seems, was enjoyment!—and such scenes must have been enacted every day during countless ages; and all this was "very good!" And it is unreasonable to call in question the truth of a scheme which assumes that all this was

ordained gratuitously, and before the sin of man brought misery and death upon the creation! To assume that, because we see it now, God has from the first ordained that it should be so, is just begging the question; and it arises from the old mistake which lies at the root of materialism and all similar errors—the mistake of not admitting moral causes for physical effects: but this is virtually denying that there is a God—it is ascribing effects solely to nature—solely to visible and palpable things—not at all to God, who, though present everywhere, and the doer of all things, is to be apprehended solely by our moral sense, not at all by our physical organs. The fallacies of the arguments of Dr. Buckland we have exposed on former occasions; and Professor Ansted's graphic picture of the gorged monster, floating like an island of black mud, is as vivid an exposure of the absurdity of calling such a state of things good, or a provision of benevolence, as any man of common sense would desire.

But, granting the supposition were true, even in that case to what a dilemma are geologists brought?—for this arrangement, which seems to them so beautiful, no longer exists!—*these races are extinct.* If the thing was abstractly good, why was it not continued to the present time? These were all inhabitants of the deep—the region they occupied was not needed for the abode of man. If these former scenes, apart

from the explanation to be derived from the fall of man, were perfectly compatible with divine wisdom and goodness, why have they ceased to be? And why does the contemplation of such scenes fill the soul with such horror, disgust, and loathing, that one cannot believe the creatures to have been so constituted at first, but that they have undergone a change?

The very fact of the extinction of these races is a change; and all the geological facts, without exception, are so many evidences of a change. Our supposition, therefore, of a previous change, deteriorating all things from what at creation they were, involves no absurdity, but is in analogy with what we learn from geology has actually taken place: but the *cause of the change* we cannot learn from geology—it lies out of the province of observation—it must be ascertained by other means: a MORAL BEING governs the universe; we therefore maintain that *in moral causes* must the reason of these changes be sought for. GOD is that BEING—in *his word* he hath given the *reasons;* and, in conformity with those declarations, shall we find the appearances of all things, and attain a solution of the perplexities occasioned by all moral and physical change: by health and sickness, life and death in man—by all the alternations of infliction and suffering in creatures that have life—by barrenness, famine, and pestilence, on the earth—all may be resolved by meditation on

that one word of God—"Cursed is the ground for thy sake; in sorrow shalt thou eat of it all the days of thy life."

We do not like the use of the word CREATION in reference to any of the facts disclosed by geology, as in such titles of books as vestiges of creation, medals of creation, or sketches of creation: it seems like holding out false colours by substituting an attractive word in places where it is not appropriate, because the true and proper word would be unattractive. Destruction, not creation, is the true expression of the facts disclosed by geological research: it is not conversant with the joyous commencement but with the melancholy termination of the past. Between us and creation the fall has placed a dark impassable gulph, and no investigation of the earth as it is can possibly make us acquainted with its primitive condition, and what it once was. Geology is like searching a charnel house, and expecting to find in the dust of the tombs a history of the living man—nay, it is as though a dead corpse could make the search or comprehend the actions of the living: for we ourselves lie under the word of death; and man has fallen from his once high estate, and vainly will endeavour by self-investigation to discover what man the lord of creation once was; and still more vainly attempt to discover what that creation was of which the lifeless wrecks and fragments alone are now

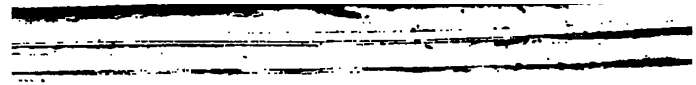
within his reach. It is by revelation that we are taught the facts of creation, and the mysteries concerning ourselves which are no longer discernible to sense, and the higher, deeper, mysteries in the mind of God, in first forming and still upholding all things: taught by revelation we can enter with gladness on the contemplation of the first origin of the earth, when the morning stars sang together and all the sons of God shouted for joy; and we can look forward with exultation to the still more glorious futurity, when the veil of sin and mortality which as yet covers the face of all things shall be removed—when death shall be swallowed up in victory, and God shall wipe away all tears for ever. Guided by the word of God the spiritual may already pierce the veil, and hold communion with the God of love, though imperfectly, and as it were for a moment; but, in the restitution of all things, the purpose and plans of God will be made patent to all; and his infinite wisdom and love, in creation, and redemption, and restitution, will be found to coincide and be openly manifest to the universe.

Creation is a word which ought not to be loosely employed. None but God can create—creation is an attribute of Deity; for it is the act by which he called out of nothingness the things that are. Creation is the bringing into being some new thing—something which had no previous existence—whether it be new mat-

ter, new life, or new spiritual endowments in the living man. It is not merely arranging or refining substances already in existence, because, anterior to such processes, there must be the qualities inherent in the substance to admit of the supposed organization, and these inherent qualities are the work of the Creator as well as the substance itself: nor can matter itself, when it has been organized, evolve the functions of life in all living beings—the life itself as well as the creature endowed with it springs from God. And the higher spiritual endowments which are peculiar to man come not from the mind of man, by presenting to his intelligence materials on which the reason may work so as to evolve spirituality—it comes by the Holy Ghost, and it is the gift of God. The spiritual man is a new creation in the proper sense of the word; and all the mistakes proceed from our reversing the true order of things, and supposing that progress is from beneath in its origin, as well as upwards in its attainments; whereas its origin is from above, and each successive step is progression upwards towards the source from whence all things came; and towards which, according as they look to their origin and avail themselves of their endowments, all men are tending. "Every good and every perfect gift is from above, and cometh down from the Father of lights, with whom is no variableness, neither shadow of turning: of his own will begat he

us with the word of truth, that we should be a kind of first fruits of his creatures."

The nebular theory, derived from the most remote of the stars, was an attempt to evade creation by a mechanical hypothesis: and, while telescopes were limited to their former range, it was not possible to refute this mechanical hypothesis by direct proof to the contrary; but Lord Rosse's more powerful instrument has dissipated this illusion, and has shown that there are no nebulæ, and that the theory is without foundation. The analogy derived from the solar system and from our own planets was employed in constructing theories concerning the primæval condition of the earth: this analogy is no longer tenable, since Dr. Woolaston has shown that the atmosphere of our earth is limited, and that the other planets have no atmosphere; and, therefore, so far as we can reason from analogy, no such plants or animals as our earth possesses, none of which could subsist without an atmosphere. The earth is therefore *sui generis* among the planets. And we believe that among the creatures each genus, and among the earths each elementary substance is also *sui generis:* made so at creation, and guarded against intermingling, by Dalton's laws, in matter, and by the laws of grafting on kindred stocks in vegetables, and by the barrenness of mules in animals; and above all other animals pre-eminently *sui generis* is man—of necessity

the noblest of the works of creation, because he was made in the image of God. *Beyond this*, the work of creation cannot go; but *up to this*, man is called to aspire, is invited, and strengthened to press forward. That man had the power to fall, and that a creature so excellent could deteriorate, is a part of the great mystery of godliness on which we cannot now enter; and that when deteriorated man should not be able to raise and restore himself is a still more important part of the same great mystery, and a still more essential element in revealing the attributes of God, and embodying them in his image—man. But, without natural theology, natural history wants its soul, and is blind, partial, and imperfect: with it, we shall be led forward to the contemplation of that new creation towards which all things are tending, and which is more than a revival of paradise—when God shall be fully revealed in all the works of his hands, and it shall be acknowledged that he hath created all things, and that for his pleasure they are and were created (Rev. iv. 11).

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